

Effects of an Iron Gate Dam Pulse Flow on the water Quality of the Klamath River

By

US Fish and Wildlife Service
Arcata Fish and Wildlife Office



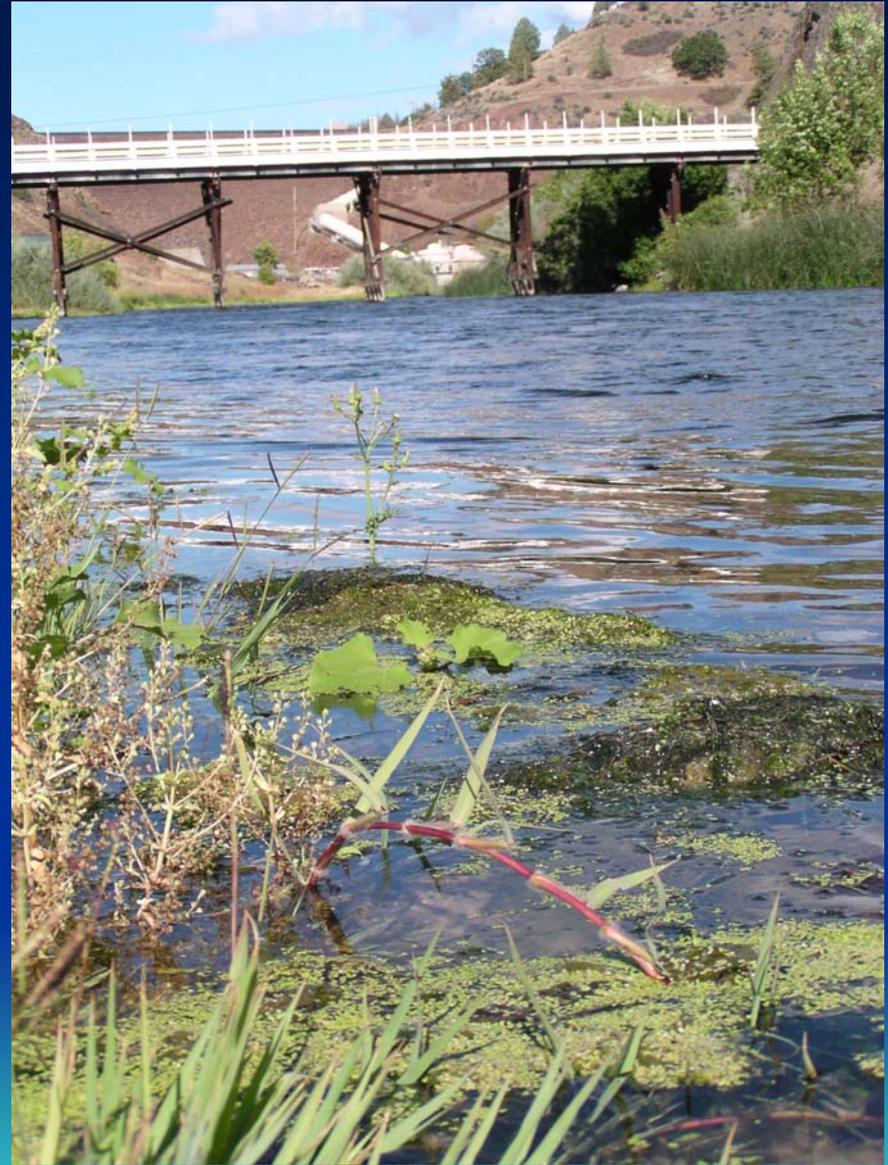
Acknowledgements

- Karuk and Yurok Tribes provided in-kind contributions of staff time in support of field work
- FWS provided \$\$ for grab sample analyses and field support



Impetus:

- Past concerns that increased flow may result in poor water quality from suspension of organic materials accumulated in the river channel during the summer
- Study opportunity presented August, 2004

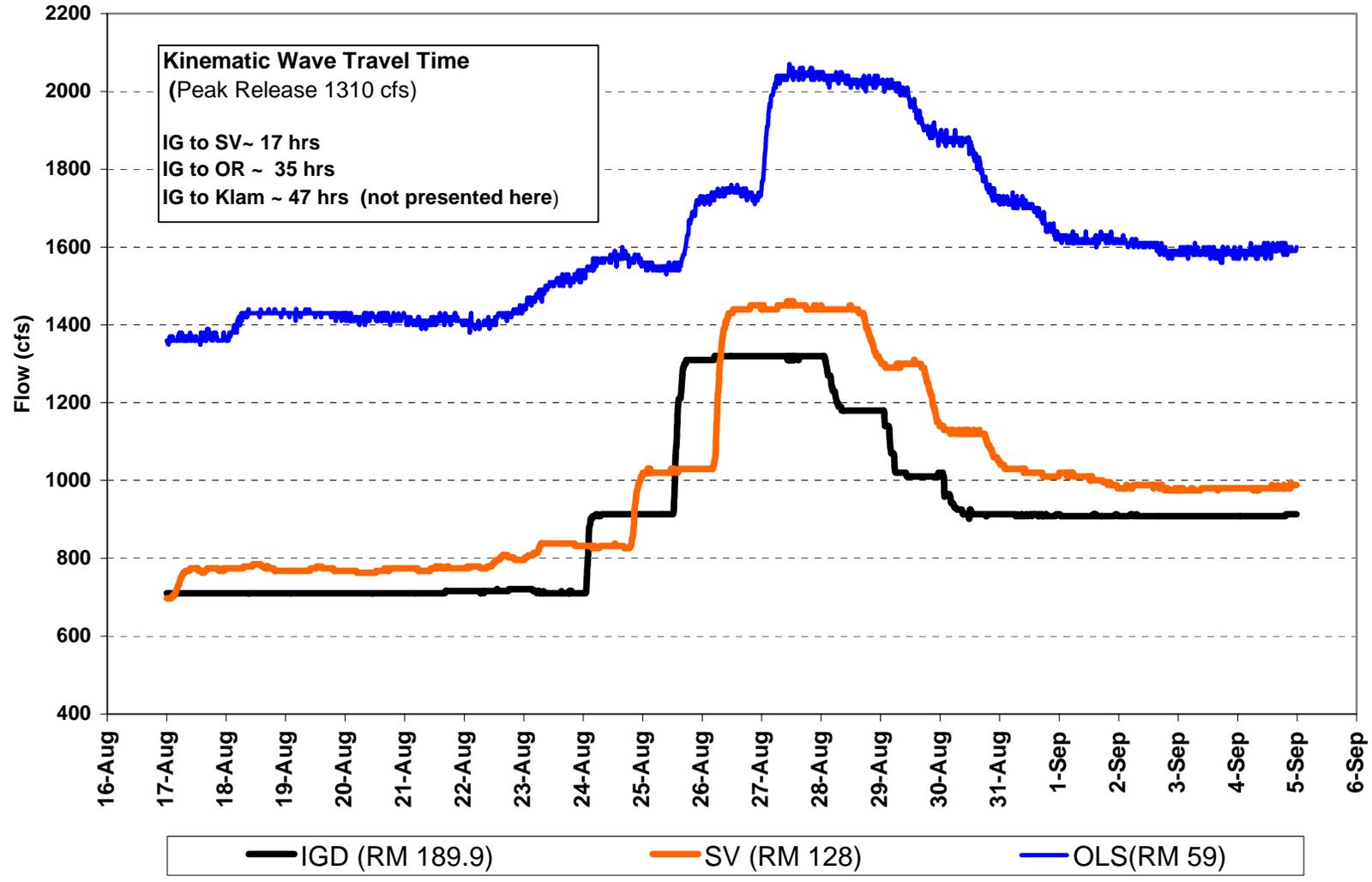


Background Information

- Yurok Tribe receives an increase in flows (stage) for ceremonial purposes near Weitchpec (Note: flow coincided with increased flow from the Trinity R.)
- IGD flow increased from 710 cfs to 1310 in late August over 40 hours



Travel Time of Iron Gate Dam Releases, 2004



Study Question: How does the flow increase affect certain variables spatially and temporally?

Variables:

- Turbidity
- Nutrient concentrations (suspension of decaying materials etc)
- Bacteria levels (i.e. Coliforms)
- pH and DO – effects to primary productivity

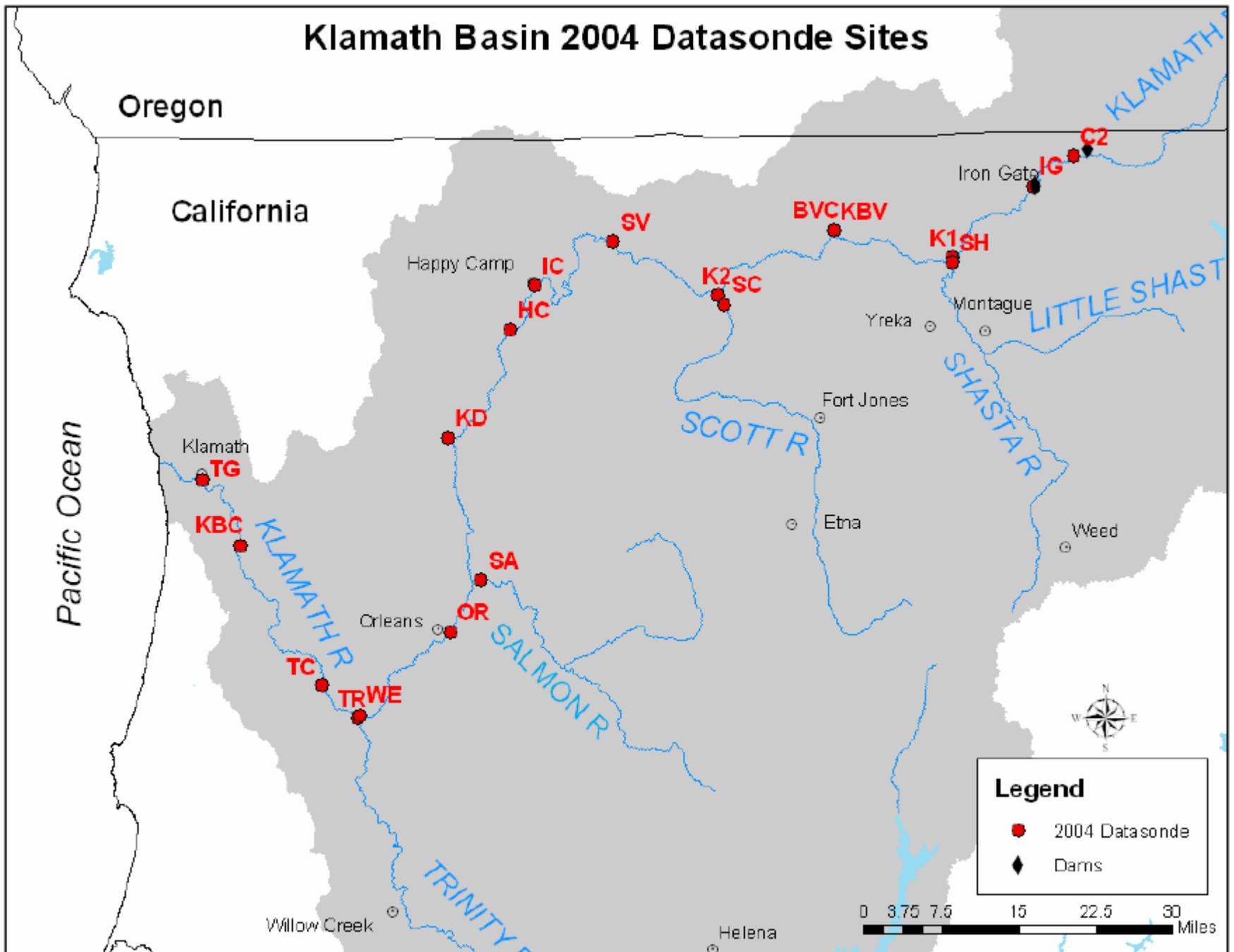


Study Design

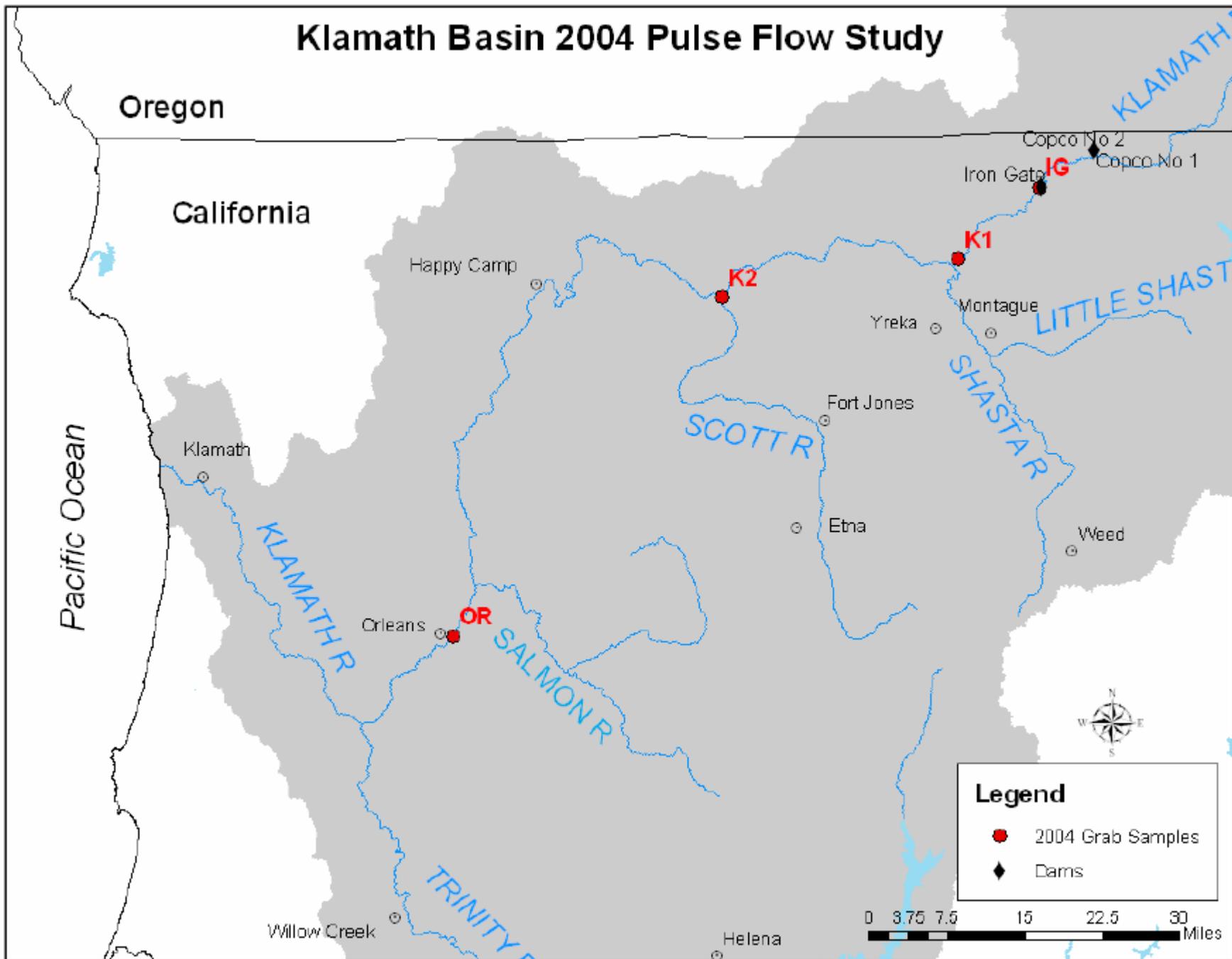
- Simple design – short notice of event
- Assessment tools: datasondes and grab samples
- Used existing datasonde network and augment grab samples
- Evaluation of source water (IGD) and downstream reaches before, during and after the event with consideration given to flow travel time and \$\$



Klamath Basin 2004 Datasonde Sites



Klamath Basin 2004 Pulse Flow Study

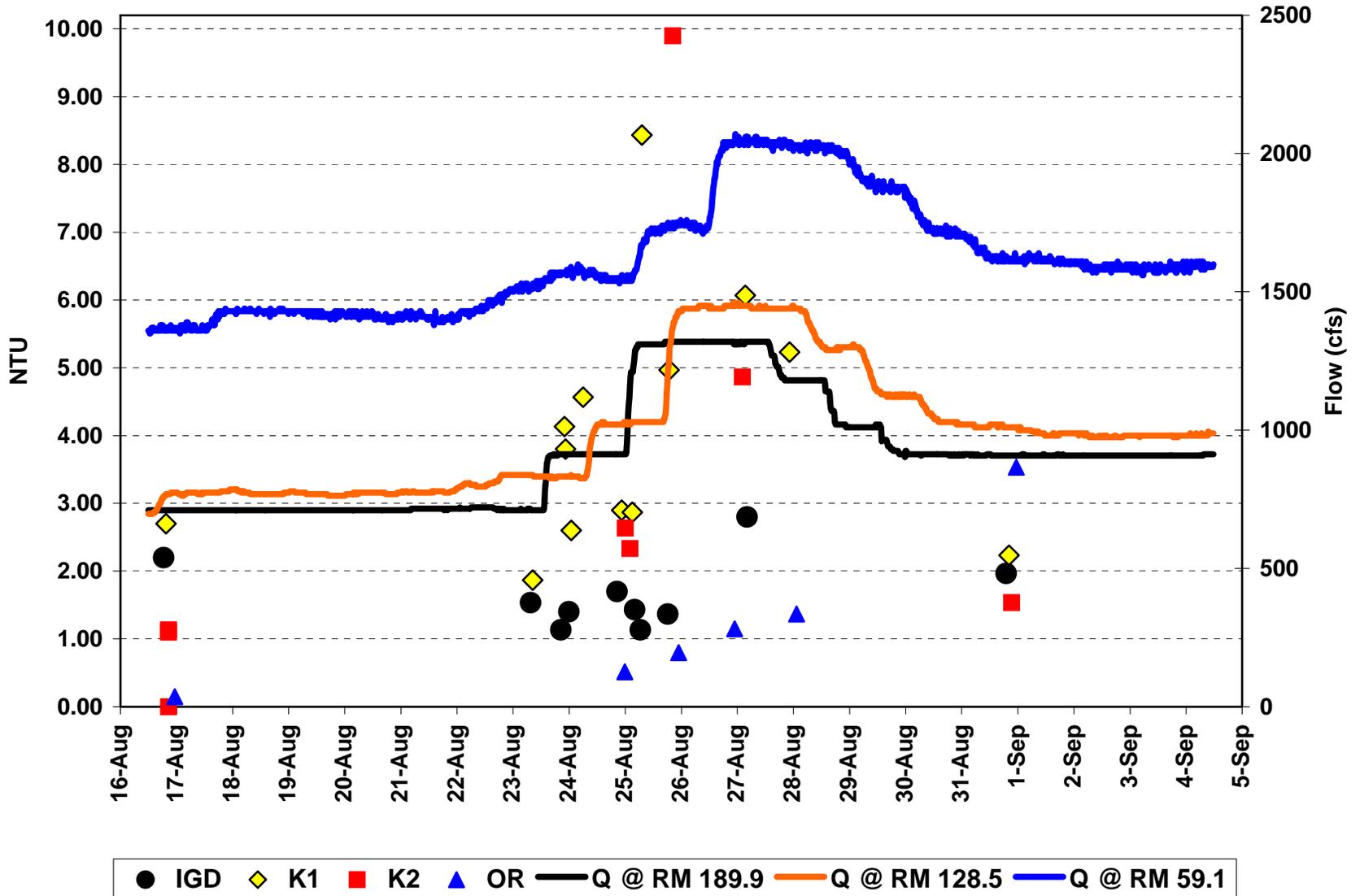


Grab Samples

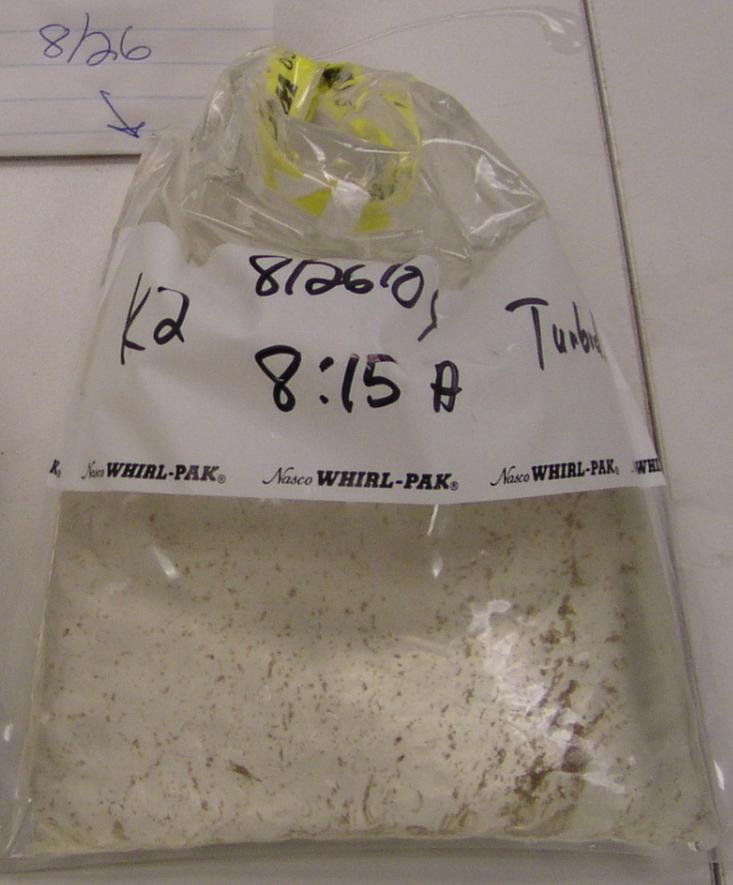
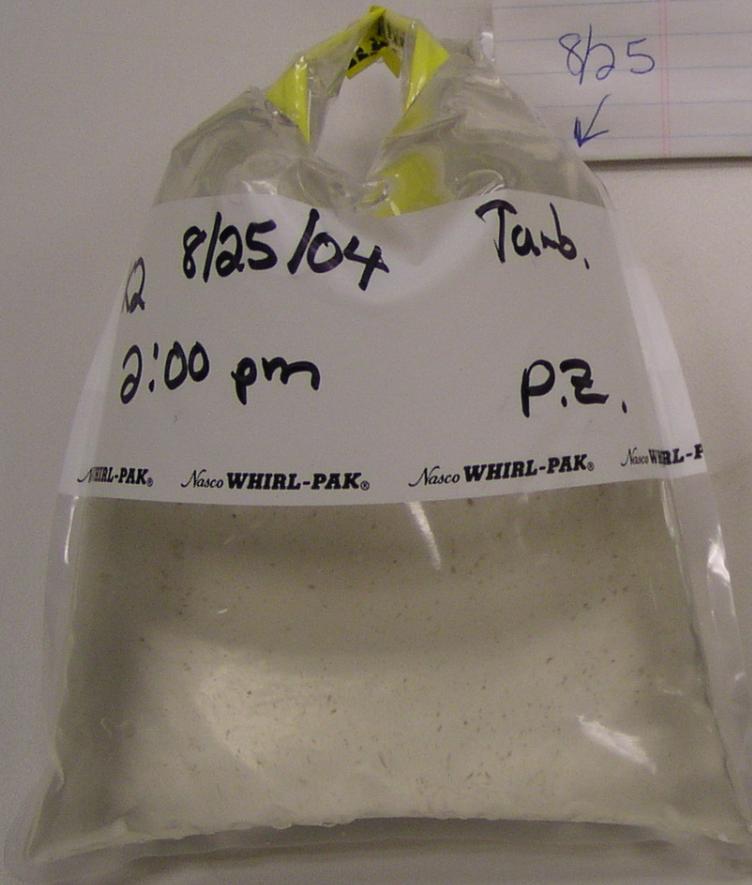
- Turbidity
- Nitrogen (TKN, Nitrate, Ammonia)
- Total and O- Phosphorus
- BOD
- Coliforms
- TOC
- Chlorophyll-a / Pheophytin



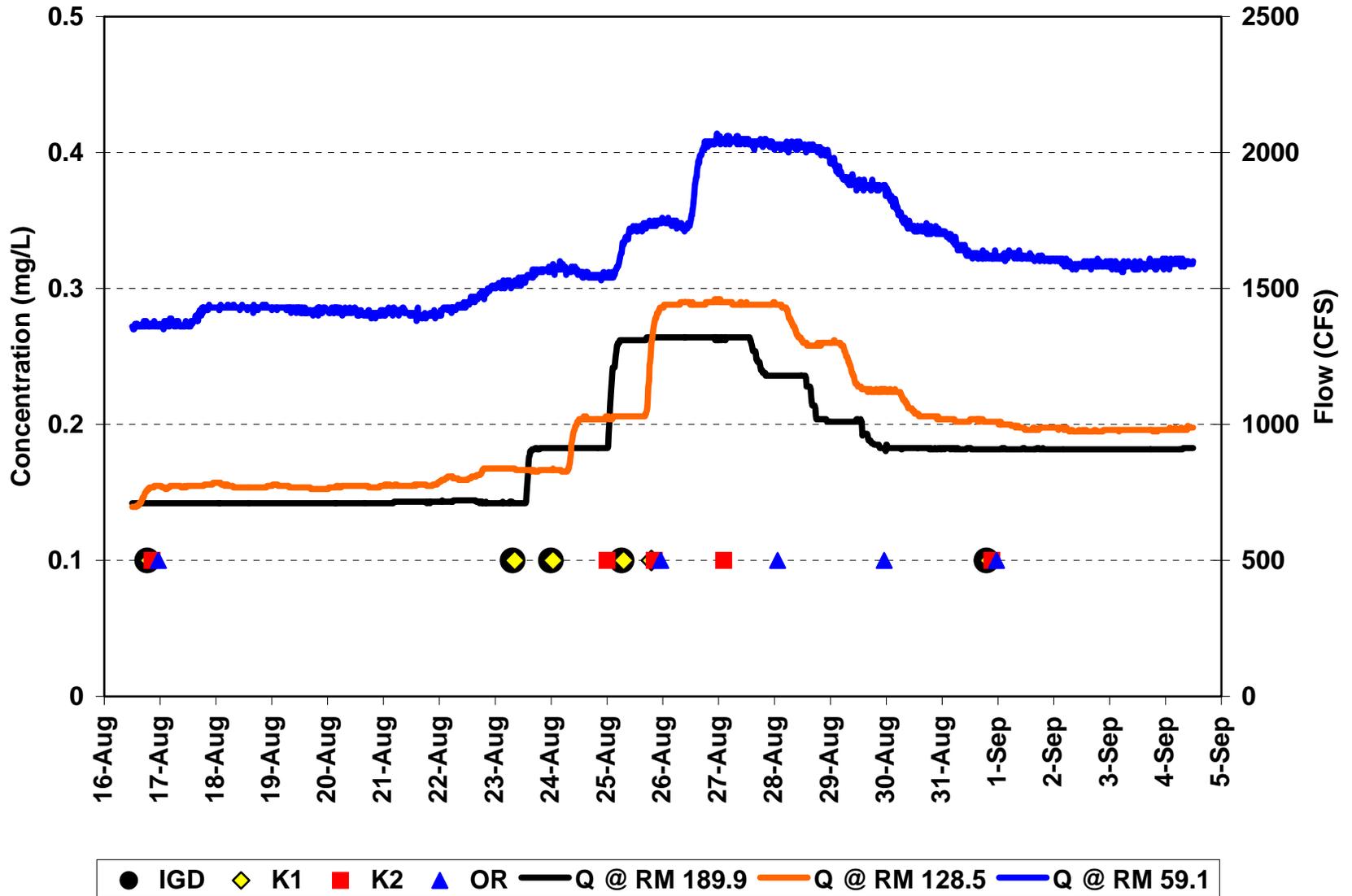
Turbidity (NTU)



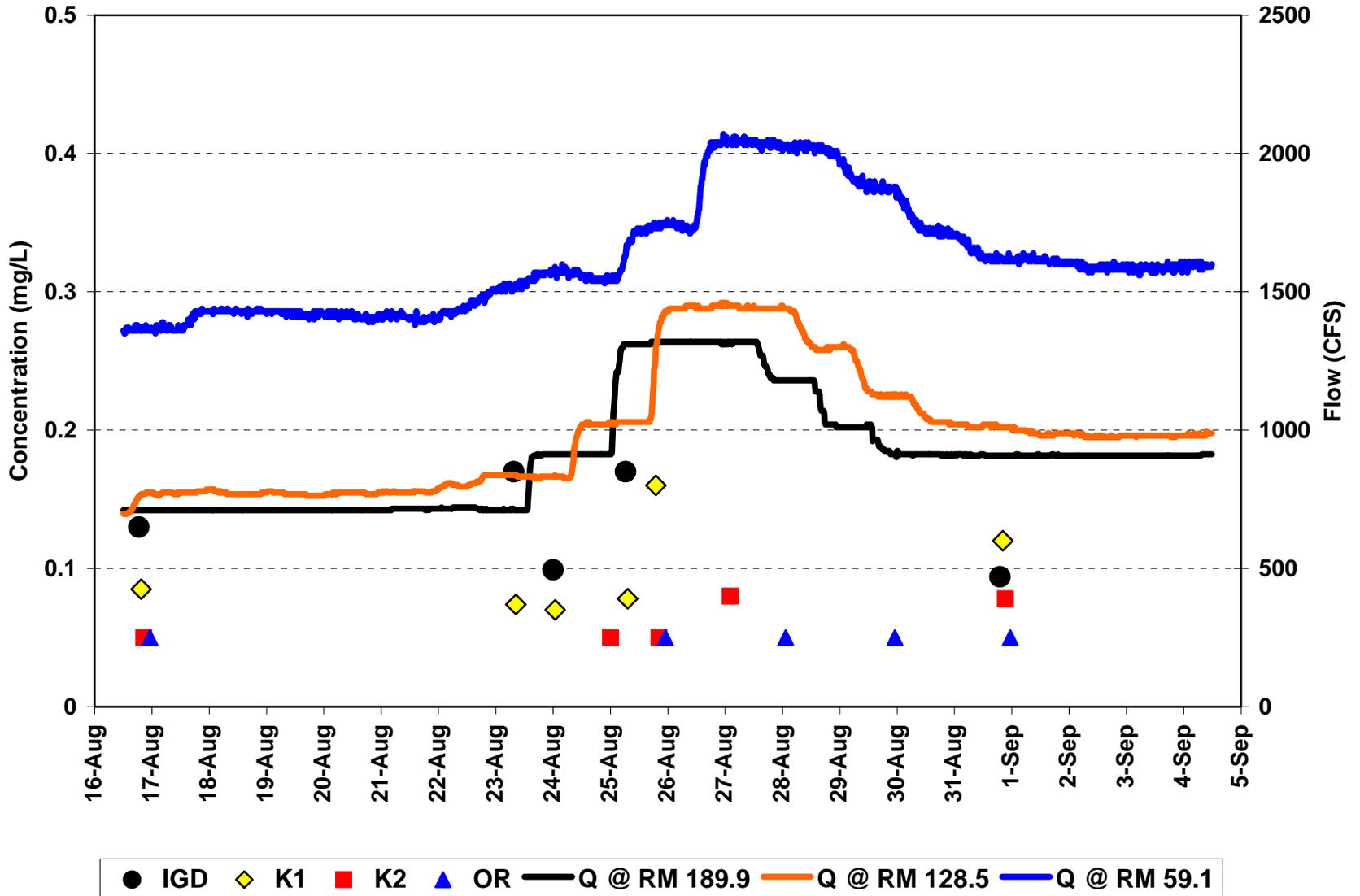
K2
8/25 8/26
↓ ↓



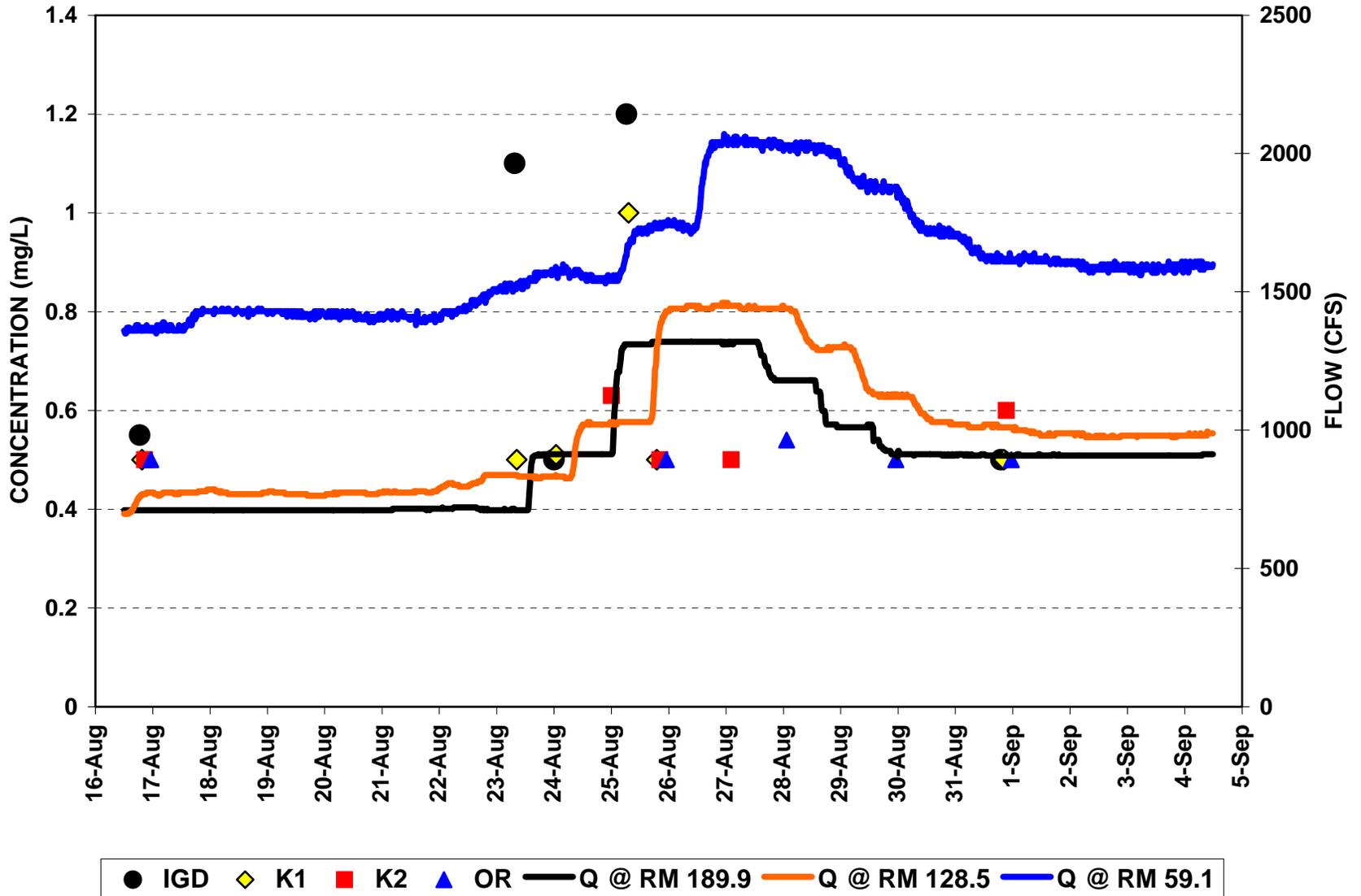
Ammonia - Detection Limit (0.1 mg/L)



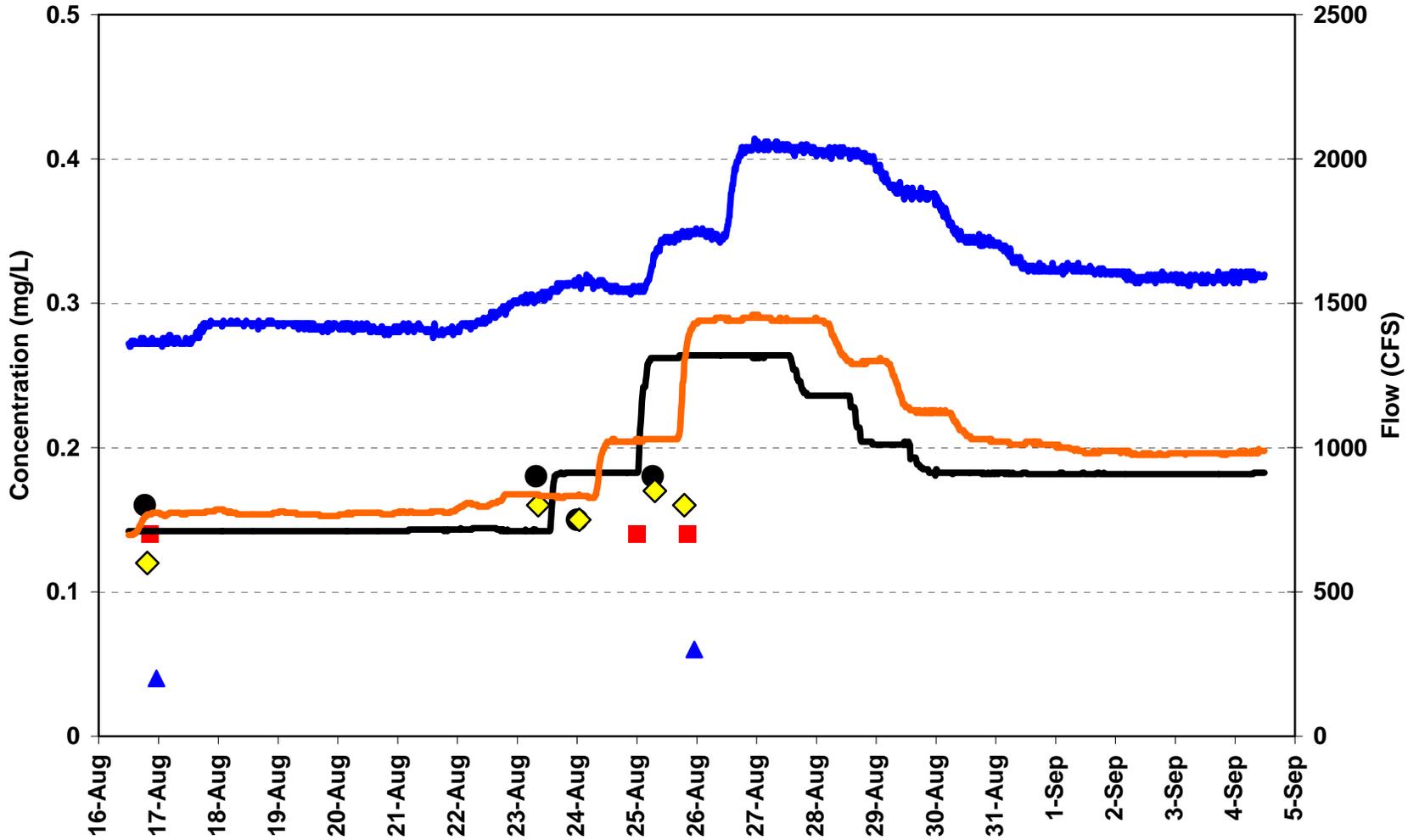
Nitrate (Dection Limit = 0.05)



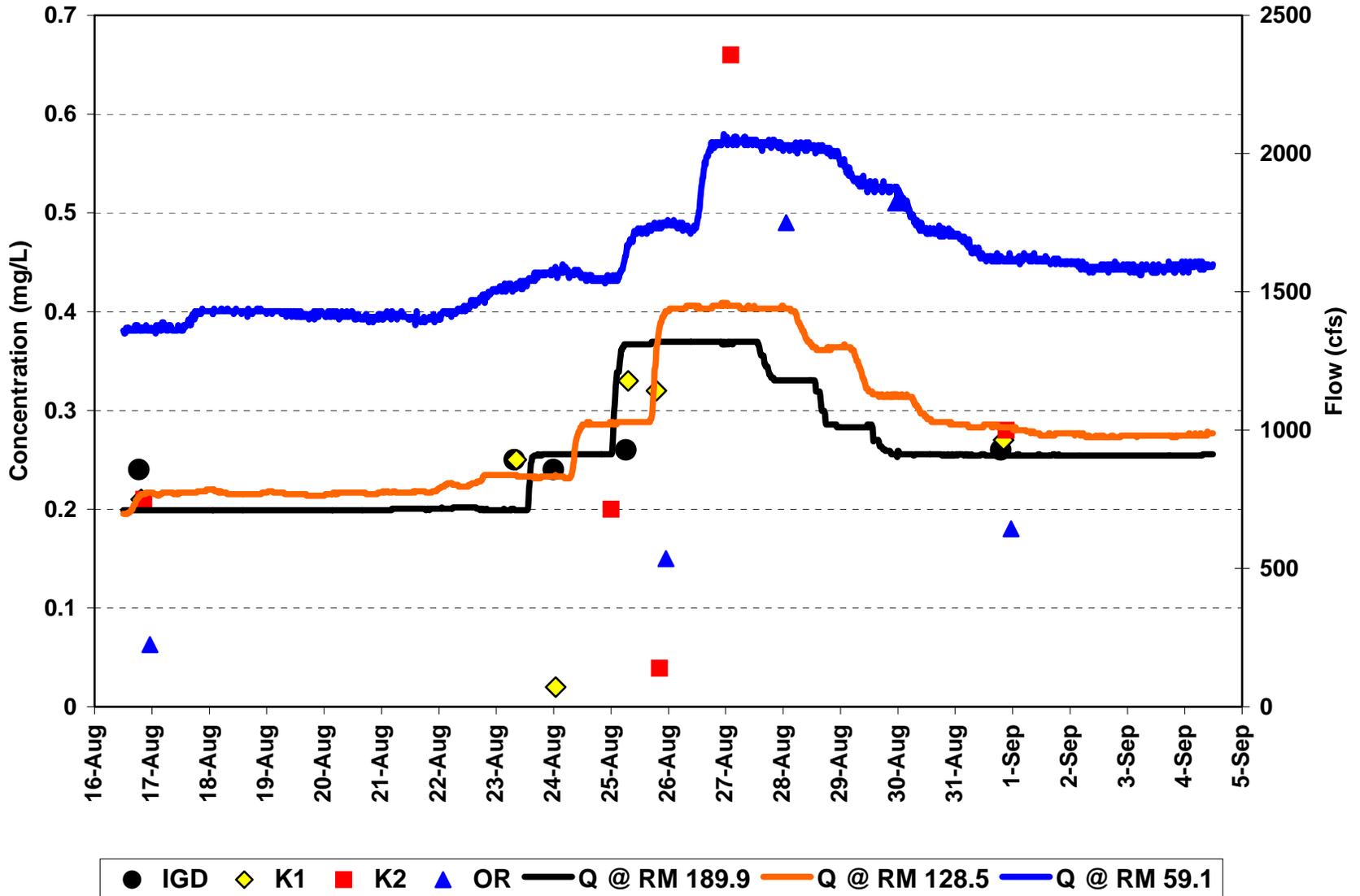
TKN (Dection Limit = 0.5)



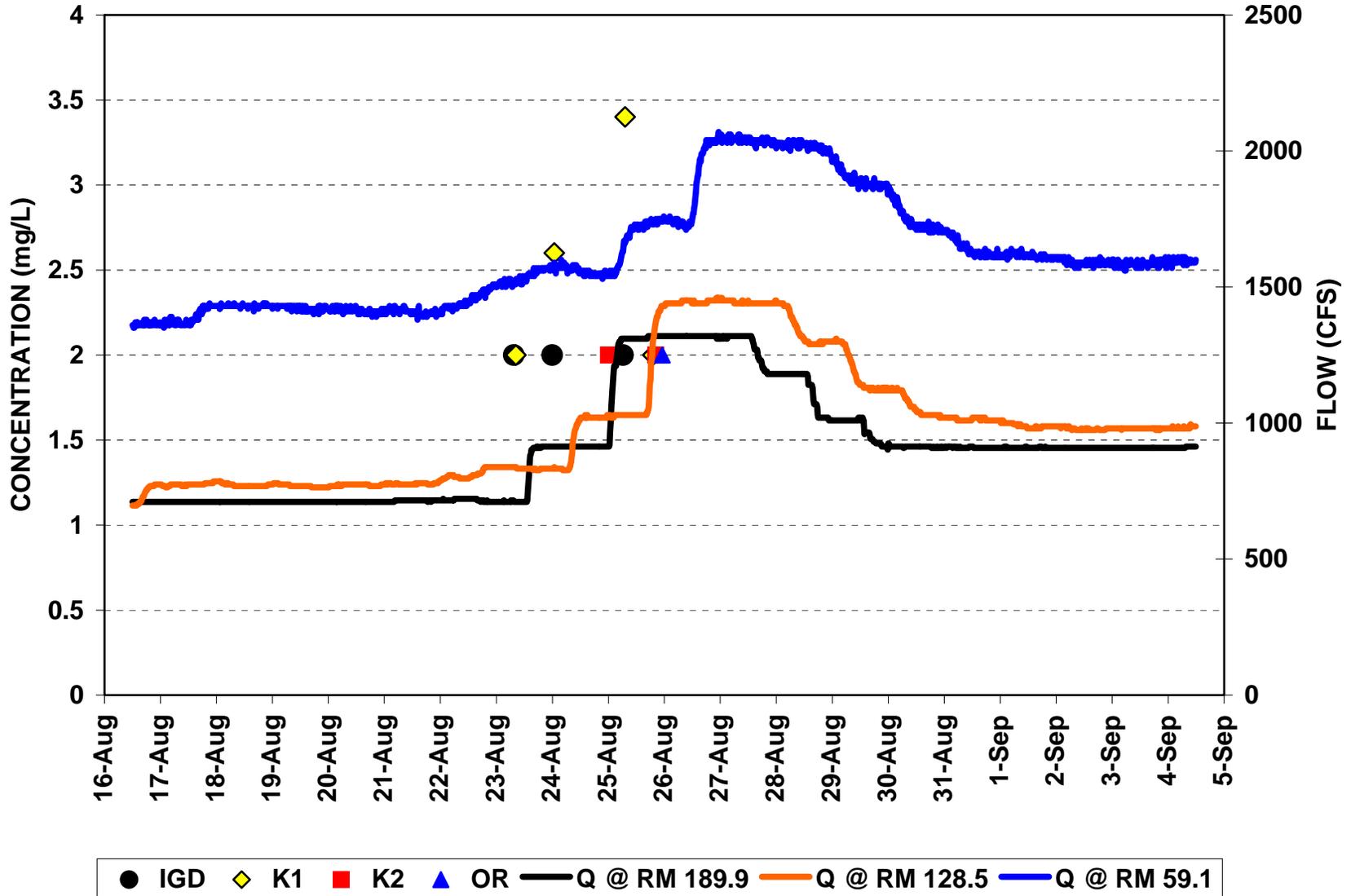
O-Phosphate (Dection Limit = 0.01)



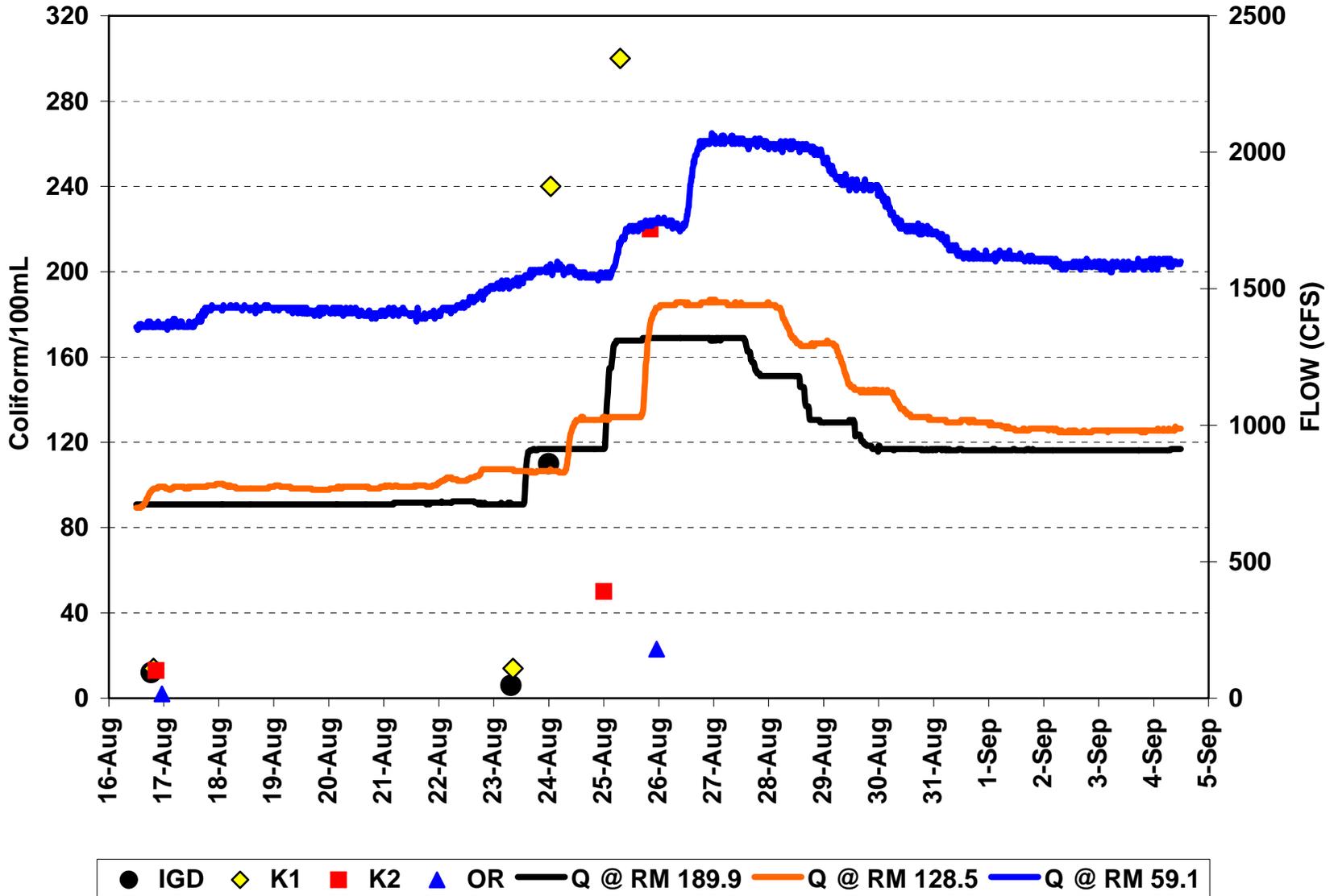
Total Phosphorus - (Detection limit 0.02 mg/L)



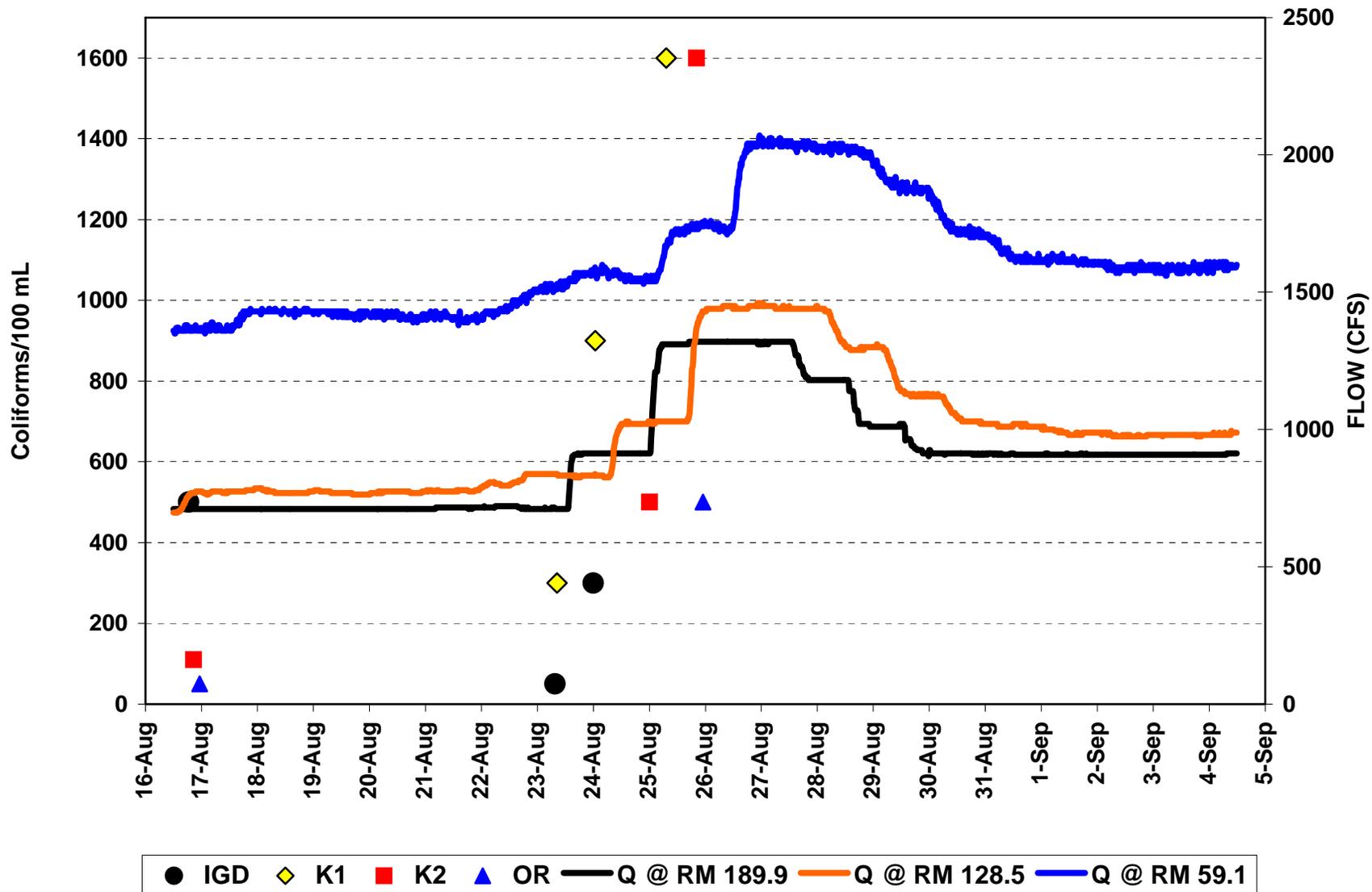
BOD - Detection Limit (2 mg/L)



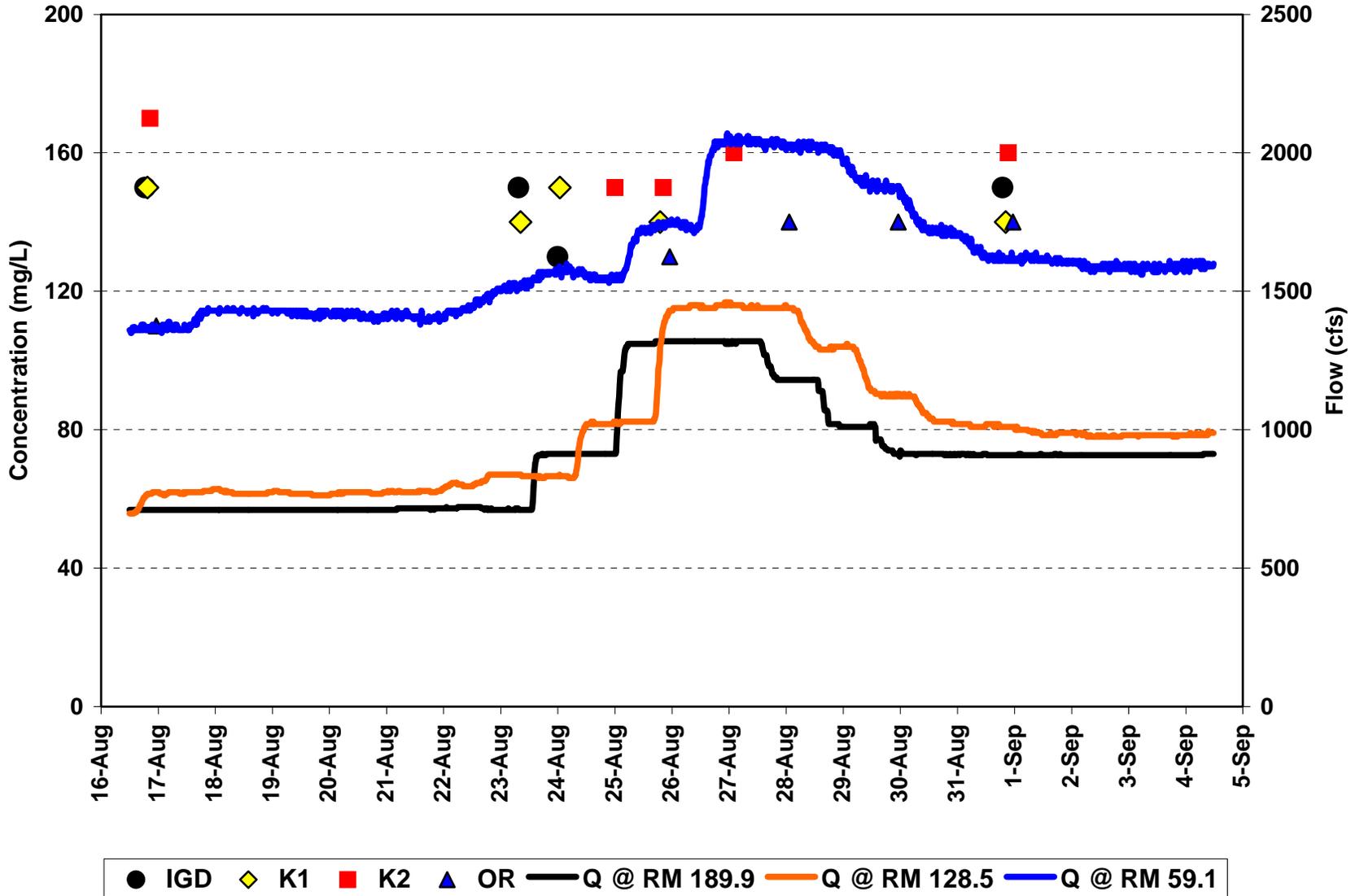
Fecal Coliform



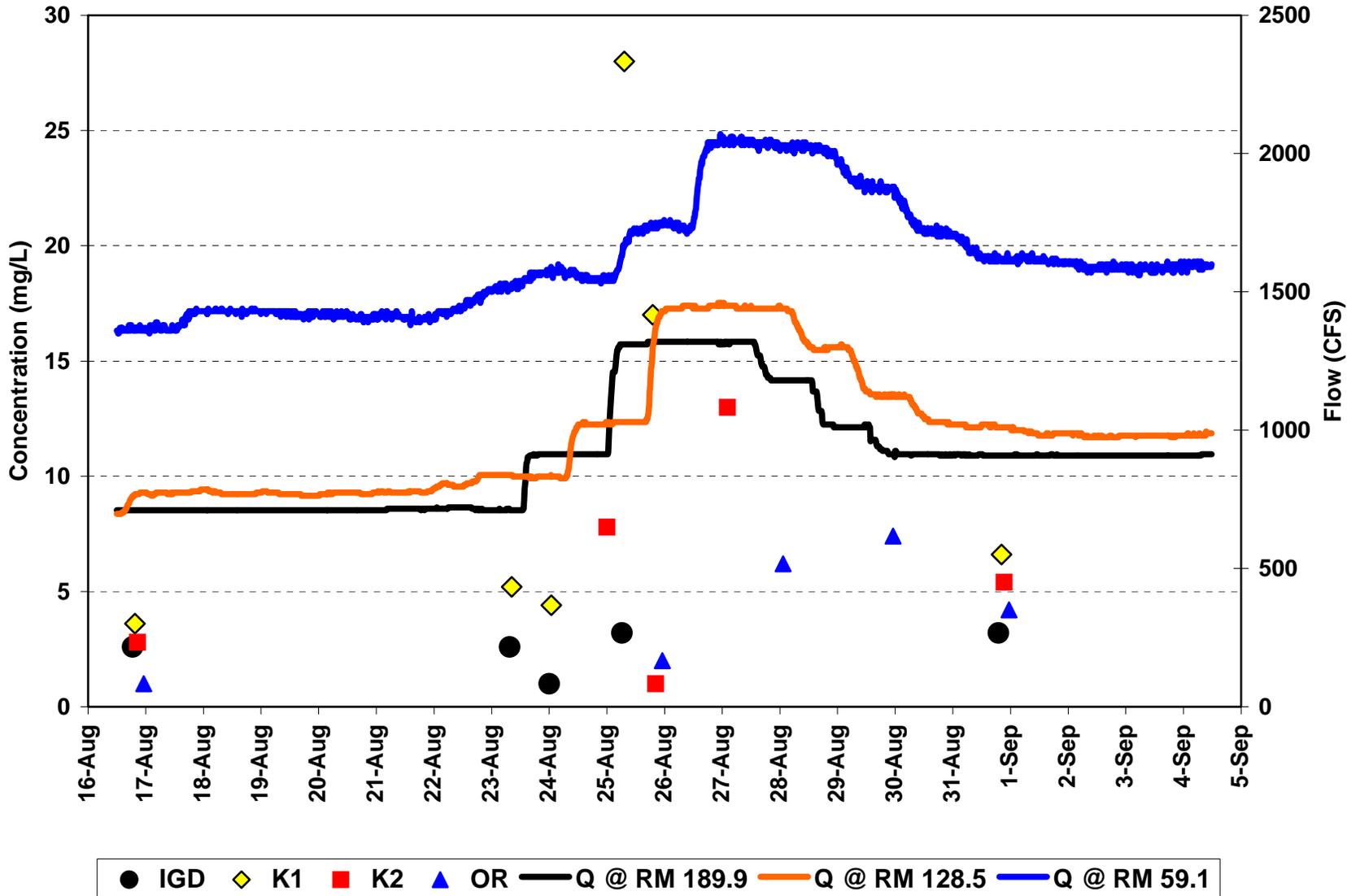
Total Coliform



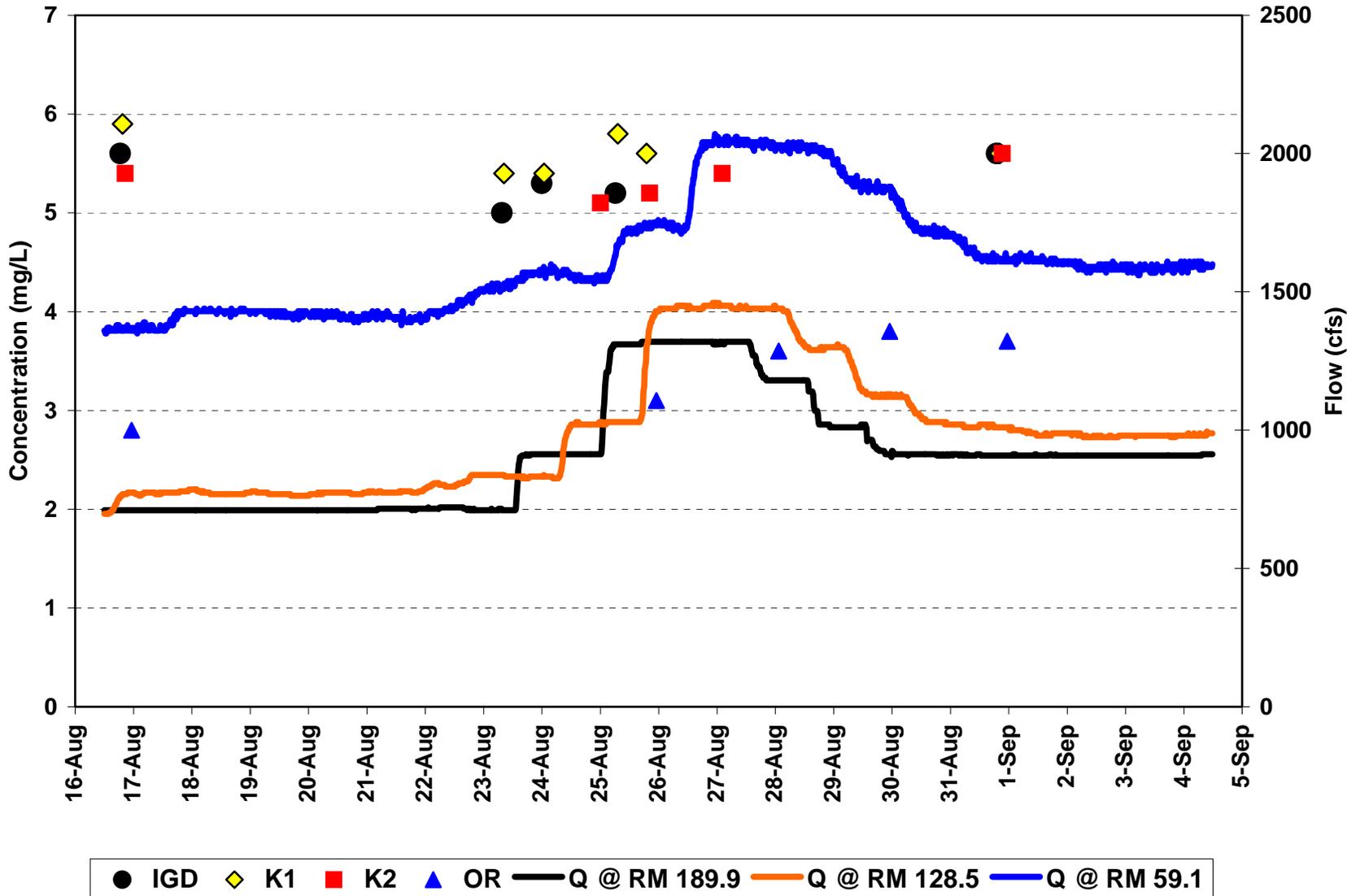
Total Dissolved Solids - (Detection limit 10 mg/L)



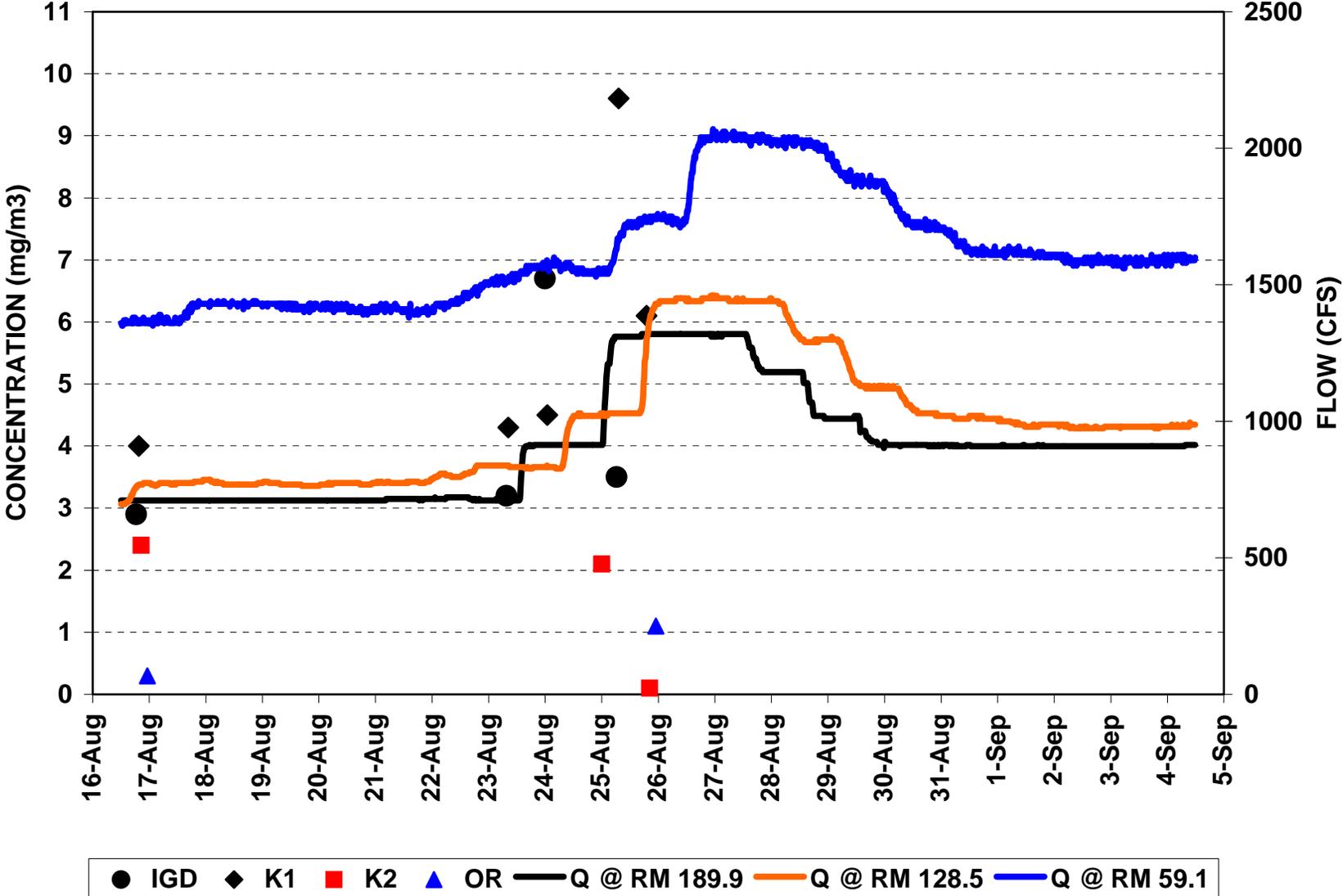
Total Suspended Solids (Dection Limit = 1)



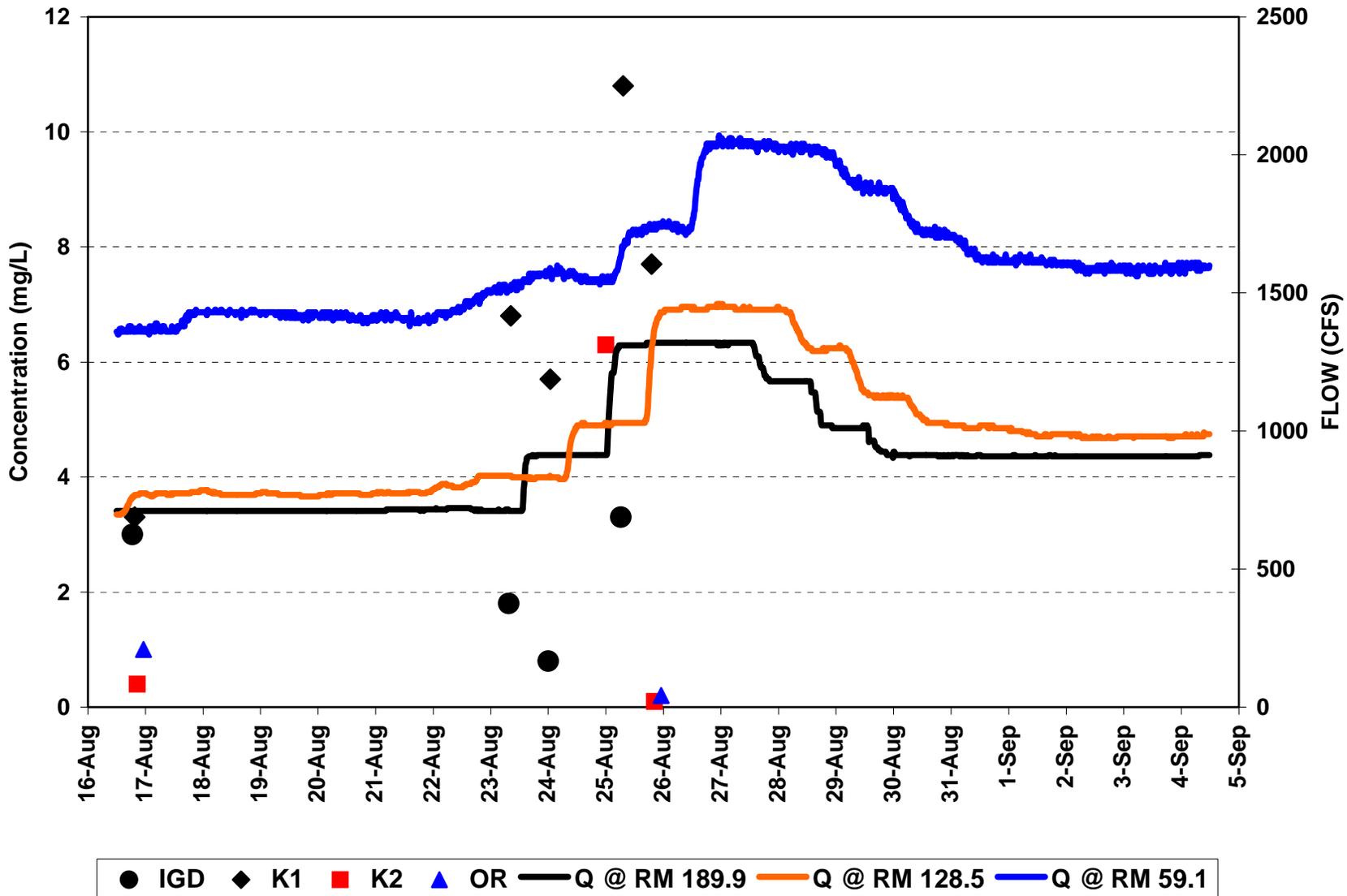
Total Organic Carbon - (Detection limit 0.3 mg/L)



Chlorophyll-a - Detection Limit (0.1 mg/L)



Pheophytin (Dection Limit = 0.1)



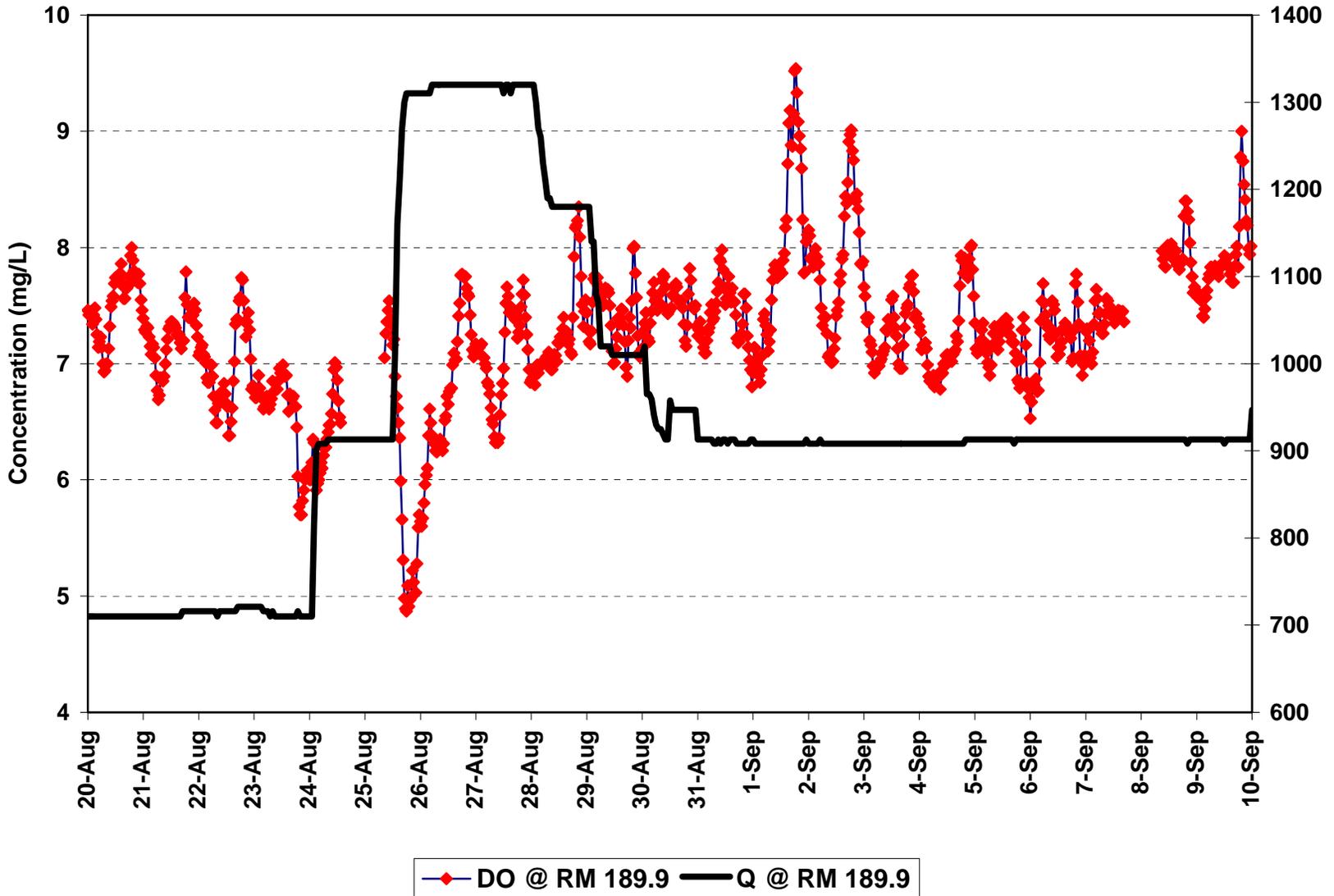
Grab Results Summary

- Pulse flow increased turbidity along the river to Orleans, and probably below.
 - Constituents that increased include:
 - T. Phosphorus (K1 to OR);
 - BOD (KR above the Shasta R.)
 - TSS (all sites)
 - T. and F. Coliforms
 - Pheophytin
- 

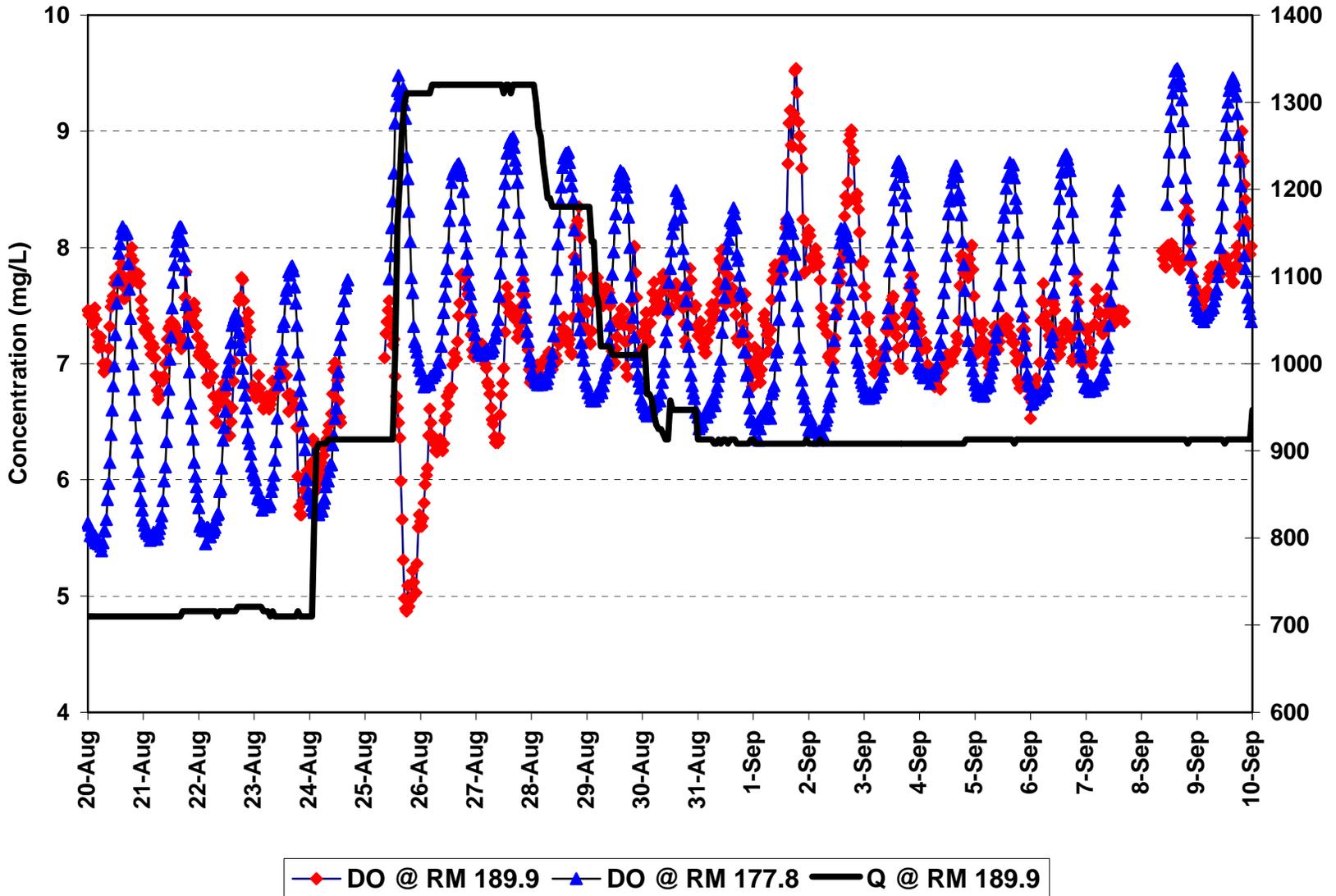
D.O. and pH



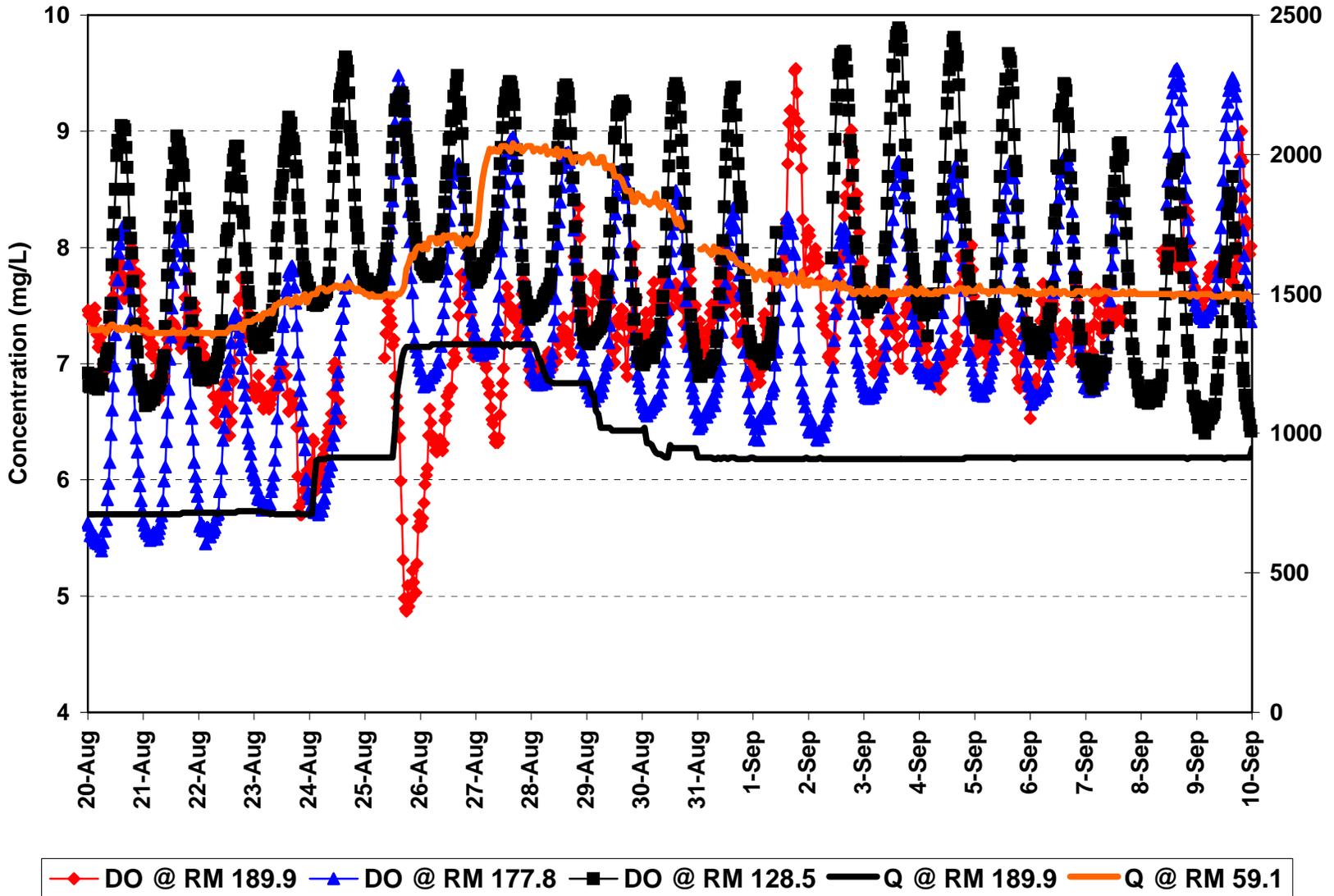
Dissolved Oxygen Levels during the Pulse Flow



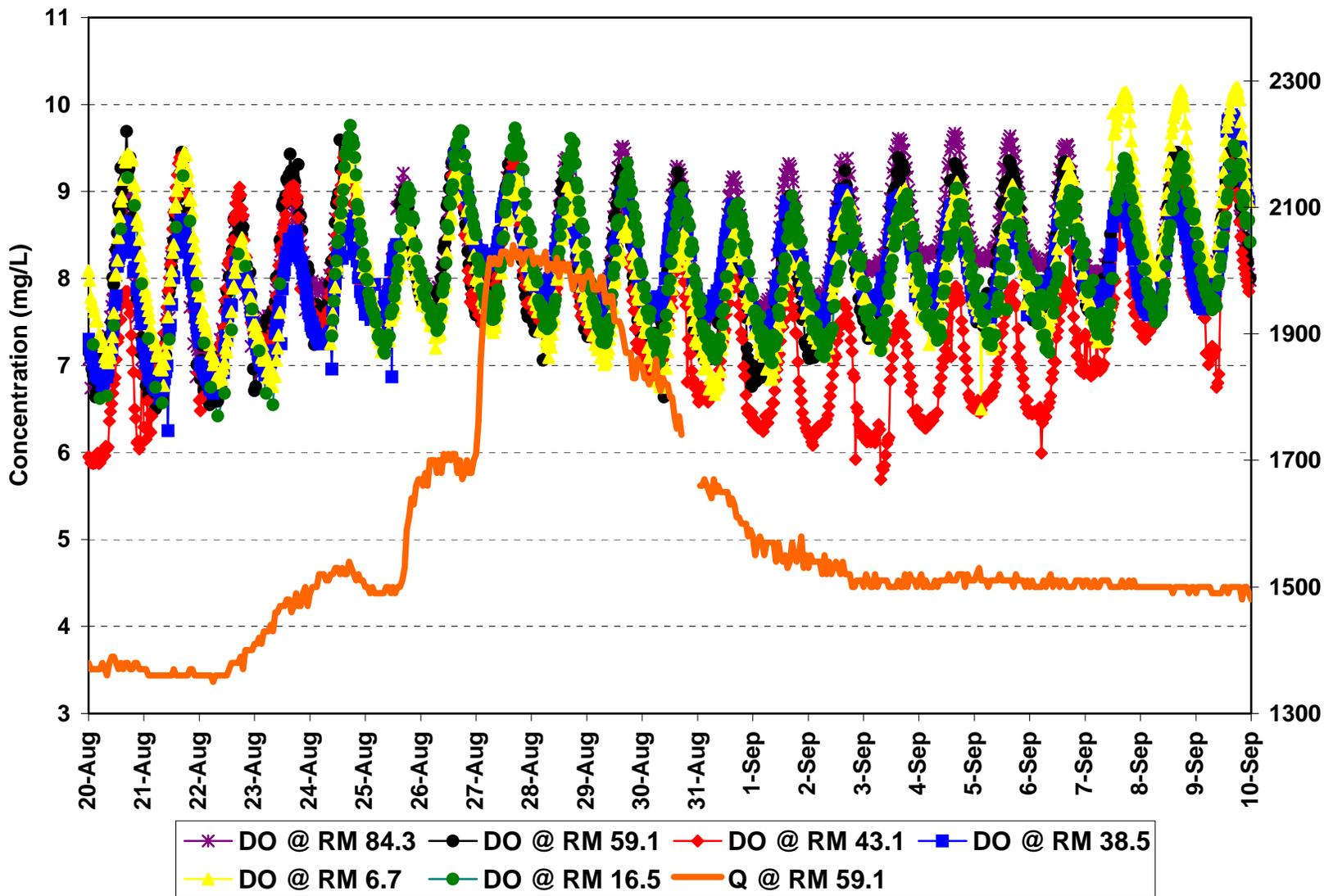
Dissolved Oxygen Levels during the Pulse Flow



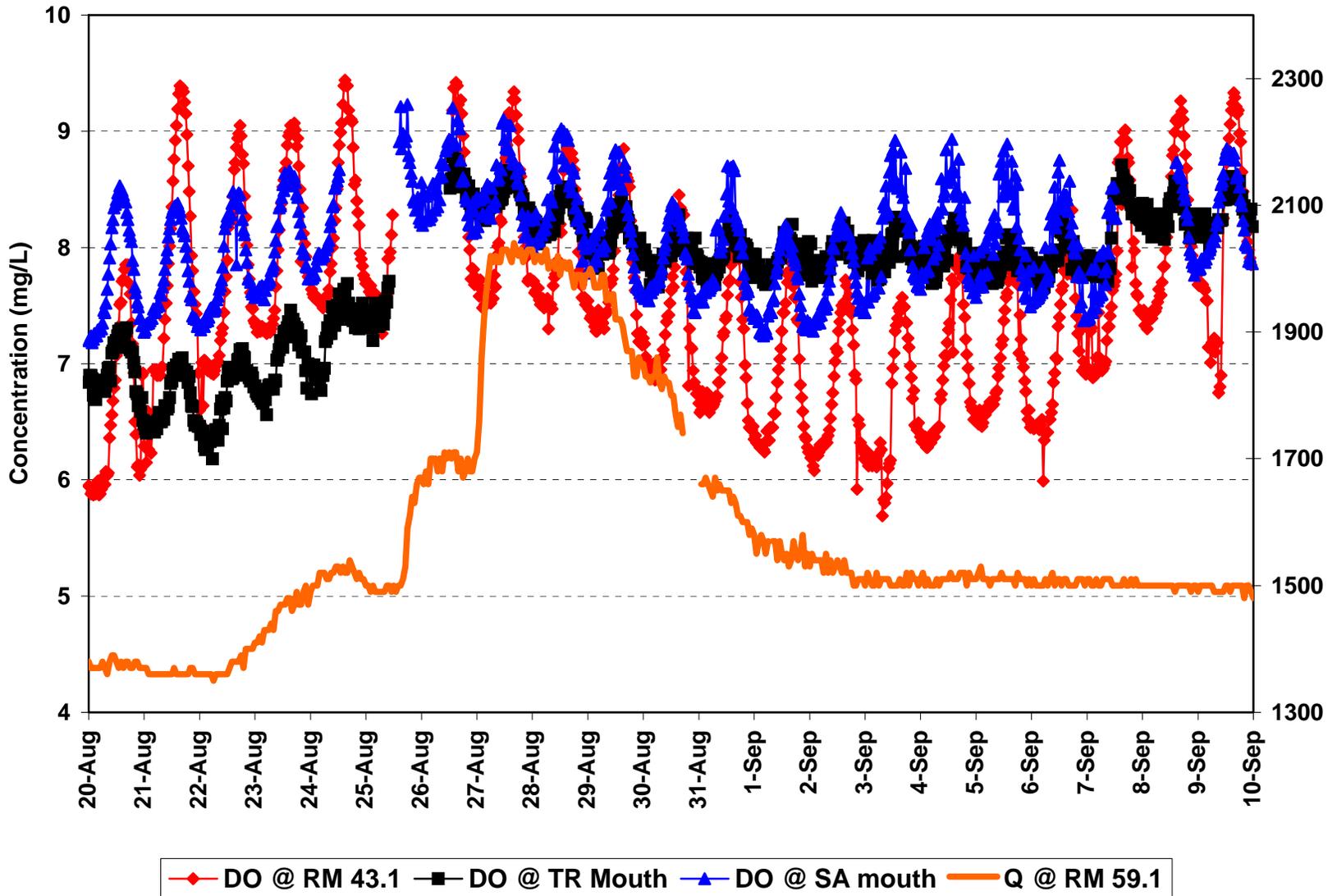
Dissolved Oxygen Levels during the Pulse Flow



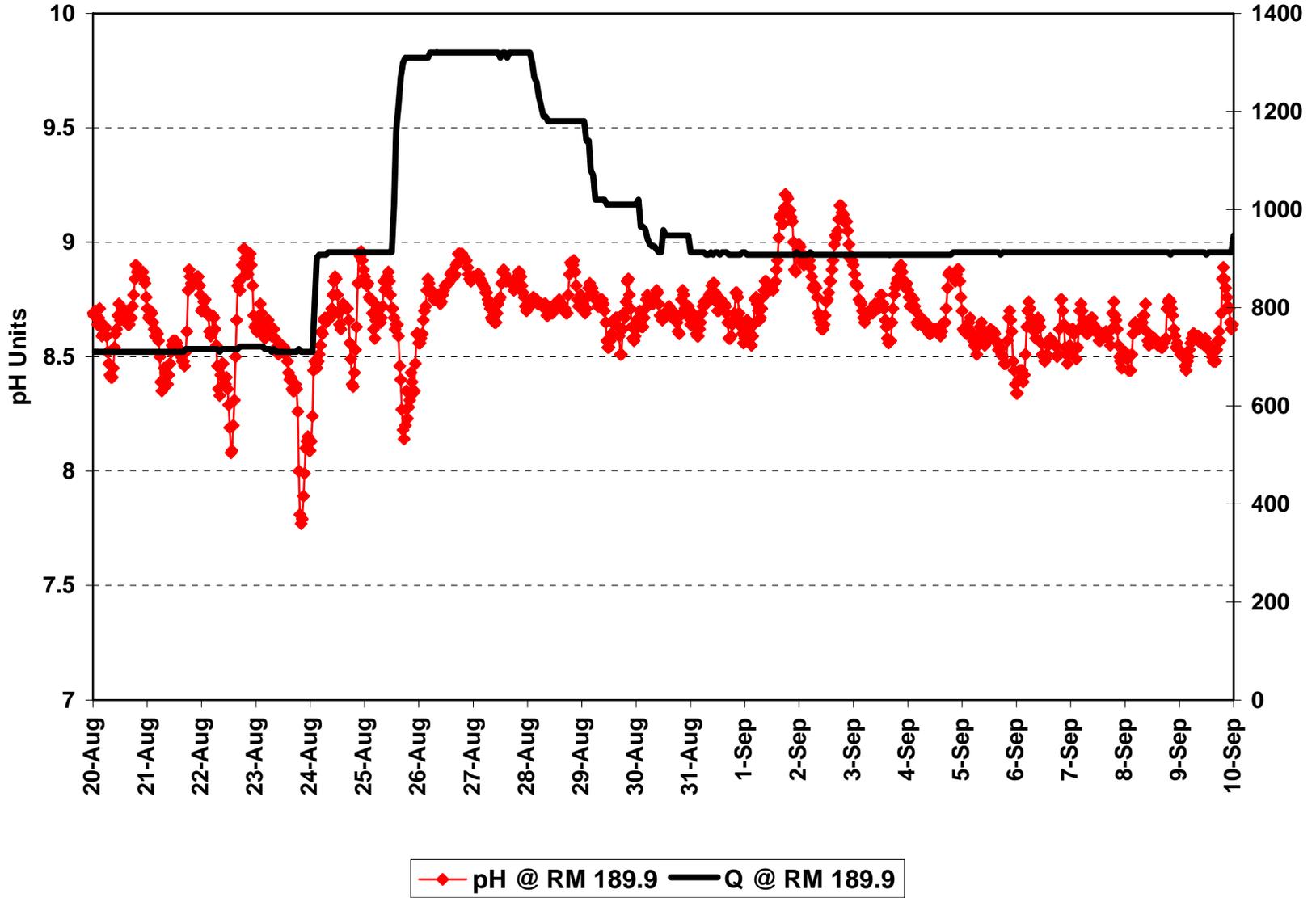
Dissolved Oxygen Levels during the Pulse Flow



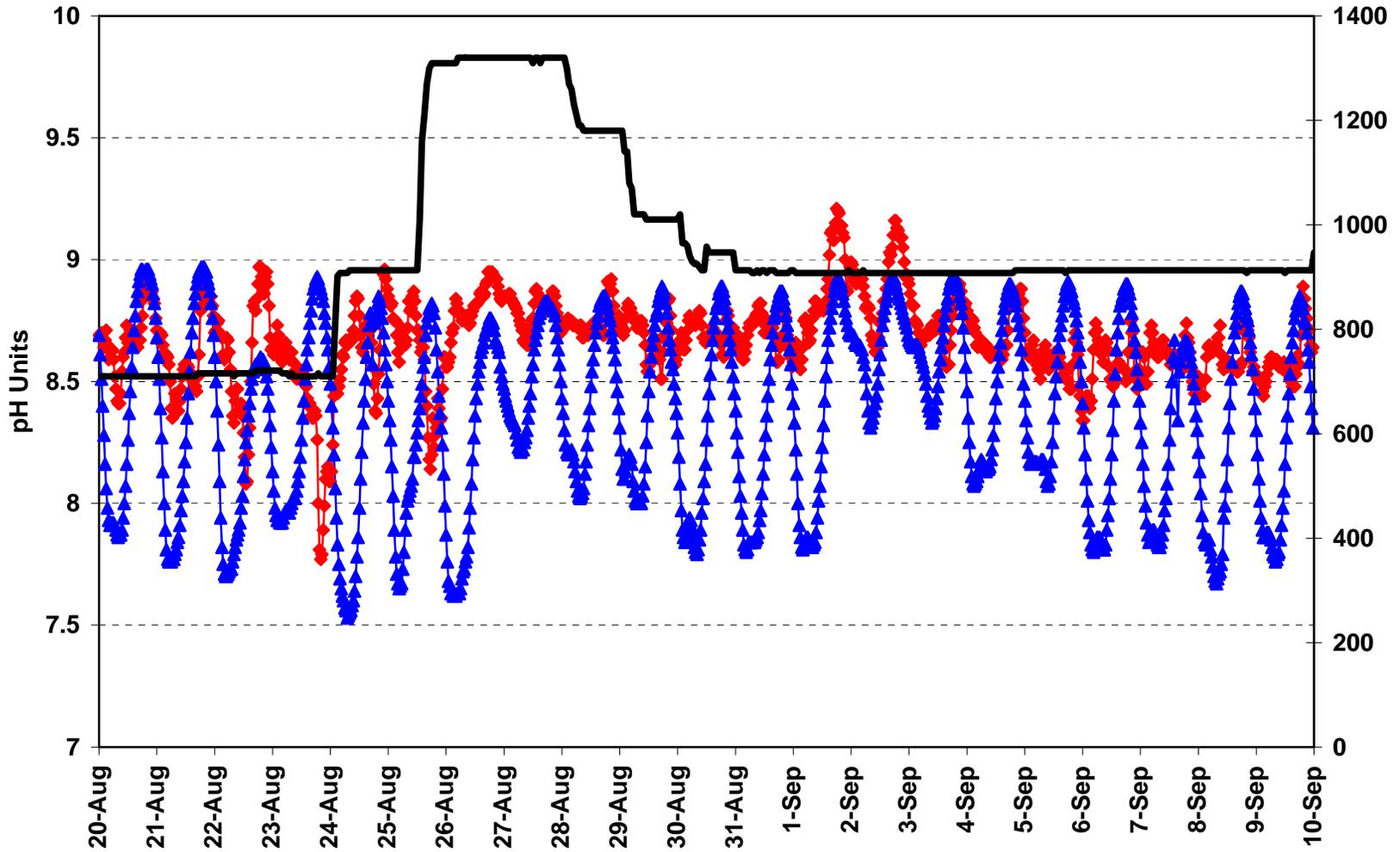
Dissolved Oxygen Levels during the Pulse Flow



pH Levels

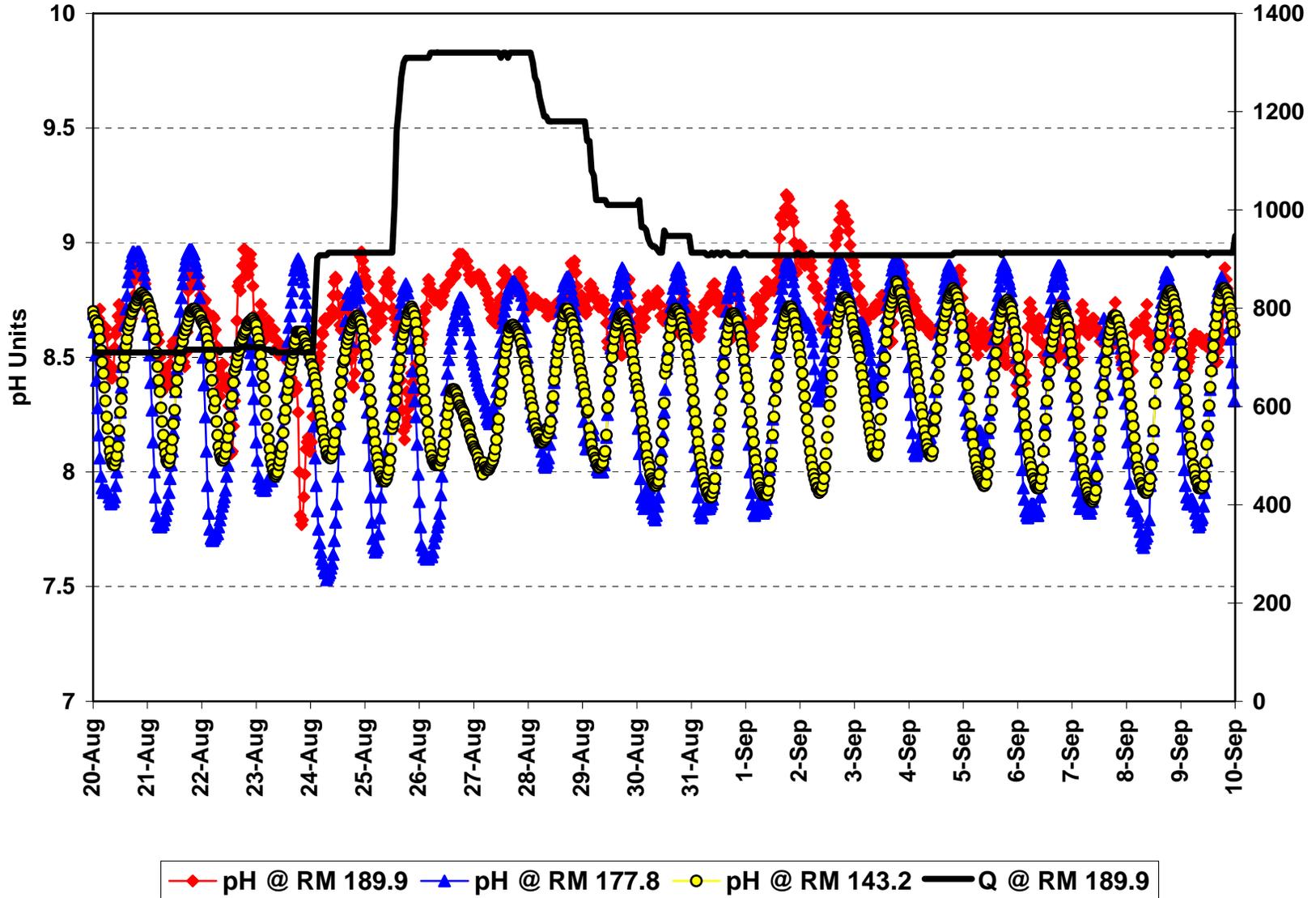


pH Levels

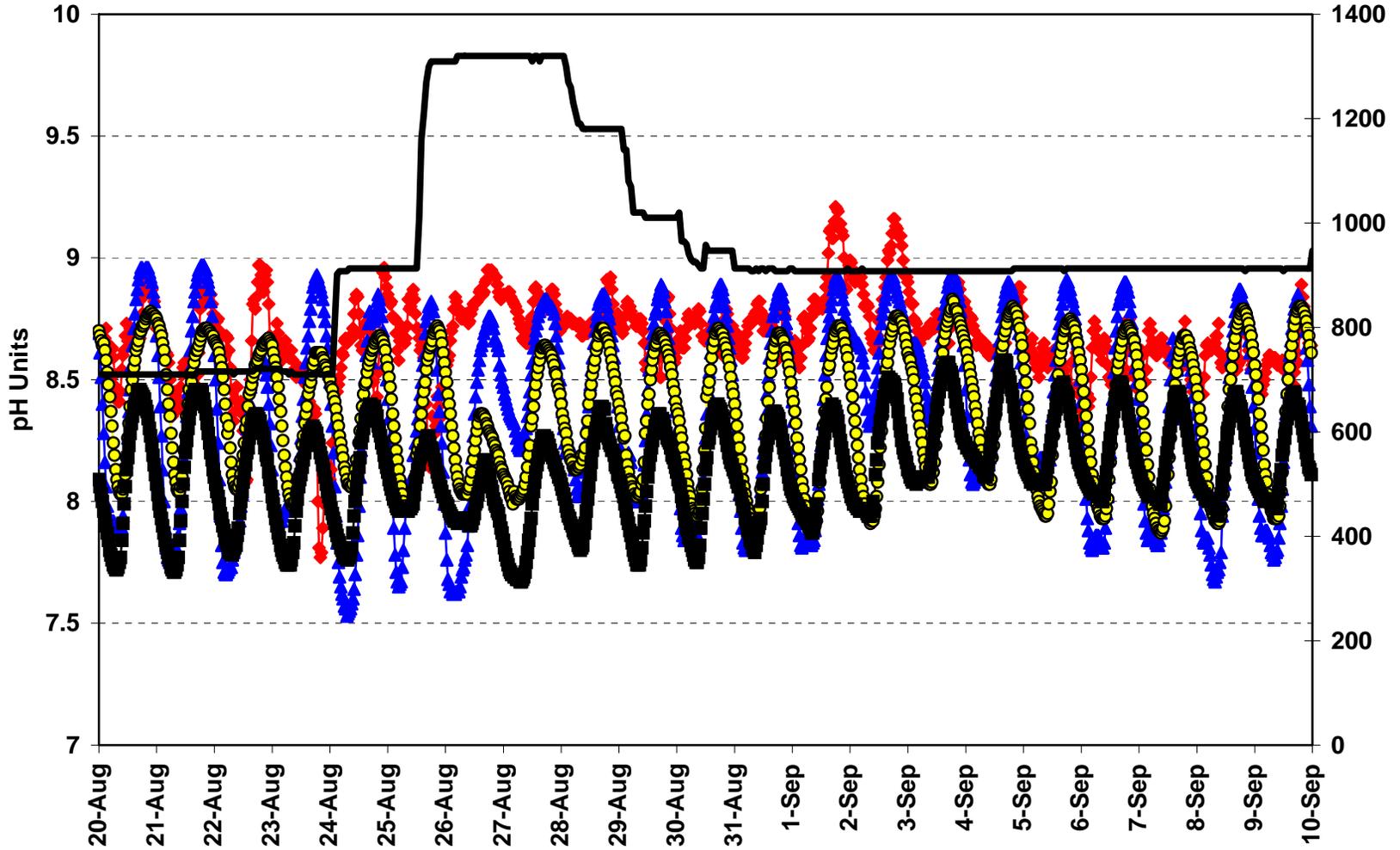


◆ pH @ RM 189.9 ▲ pH @ RM 177.8 — Q @ RM 189.9

pH Levels

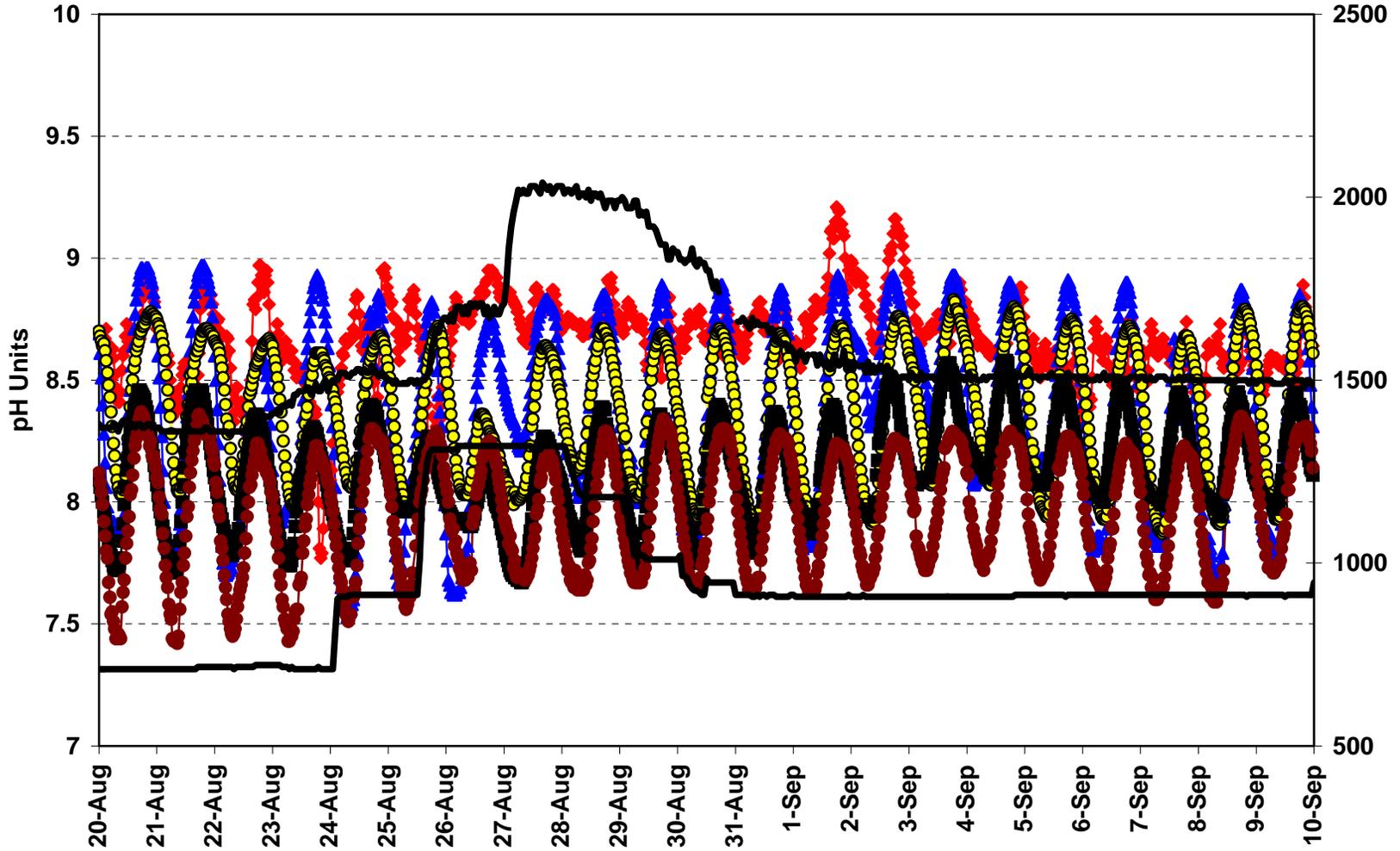


pH Levels

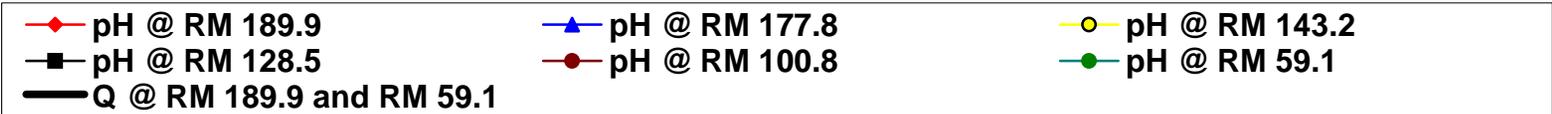
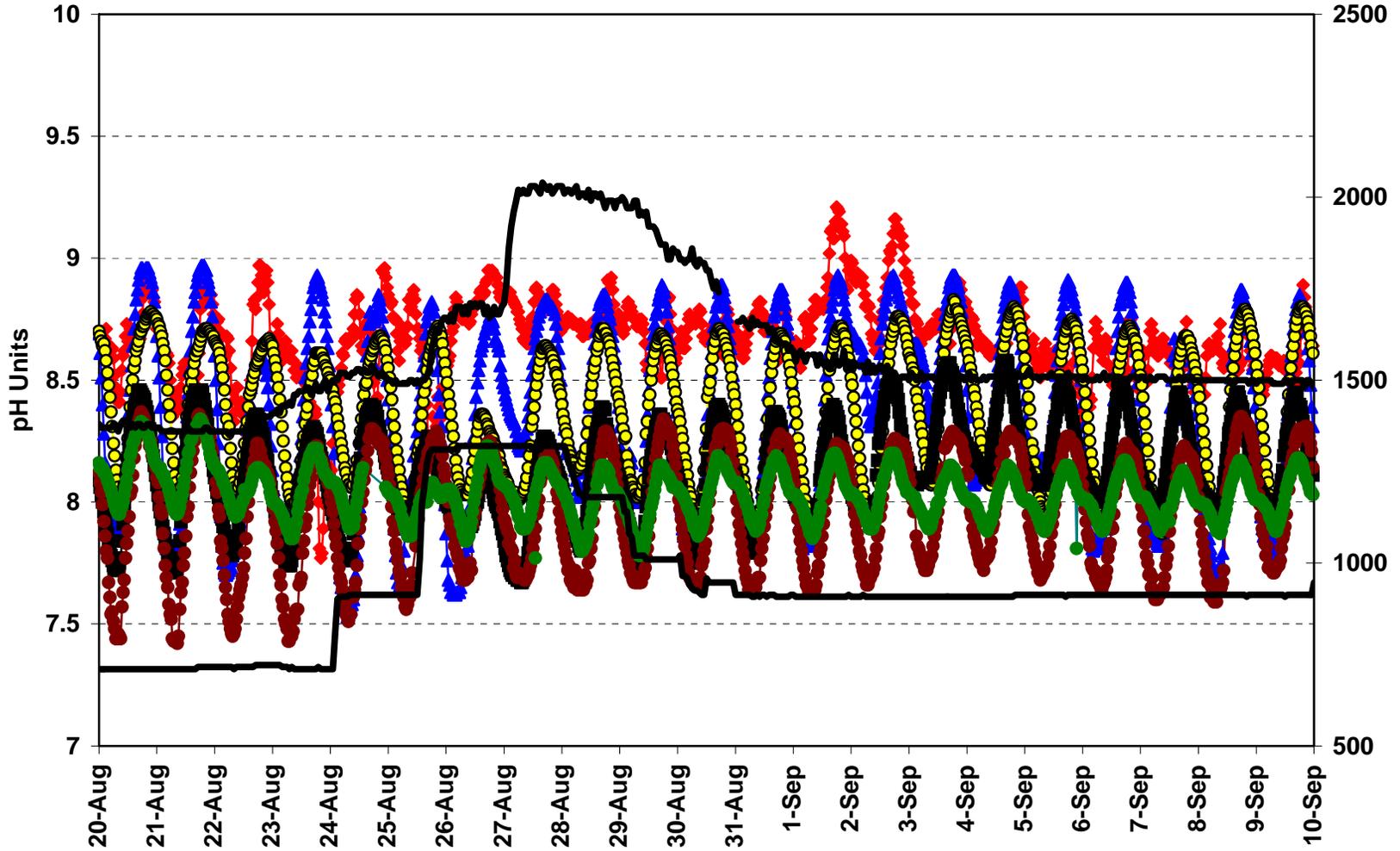


◆ pH @ RM 189.9 ▲ pH @ RM 177.8 ● pH @ RM 143.2 ■ pH @ RM 128.5 — Q @ RM 189.9

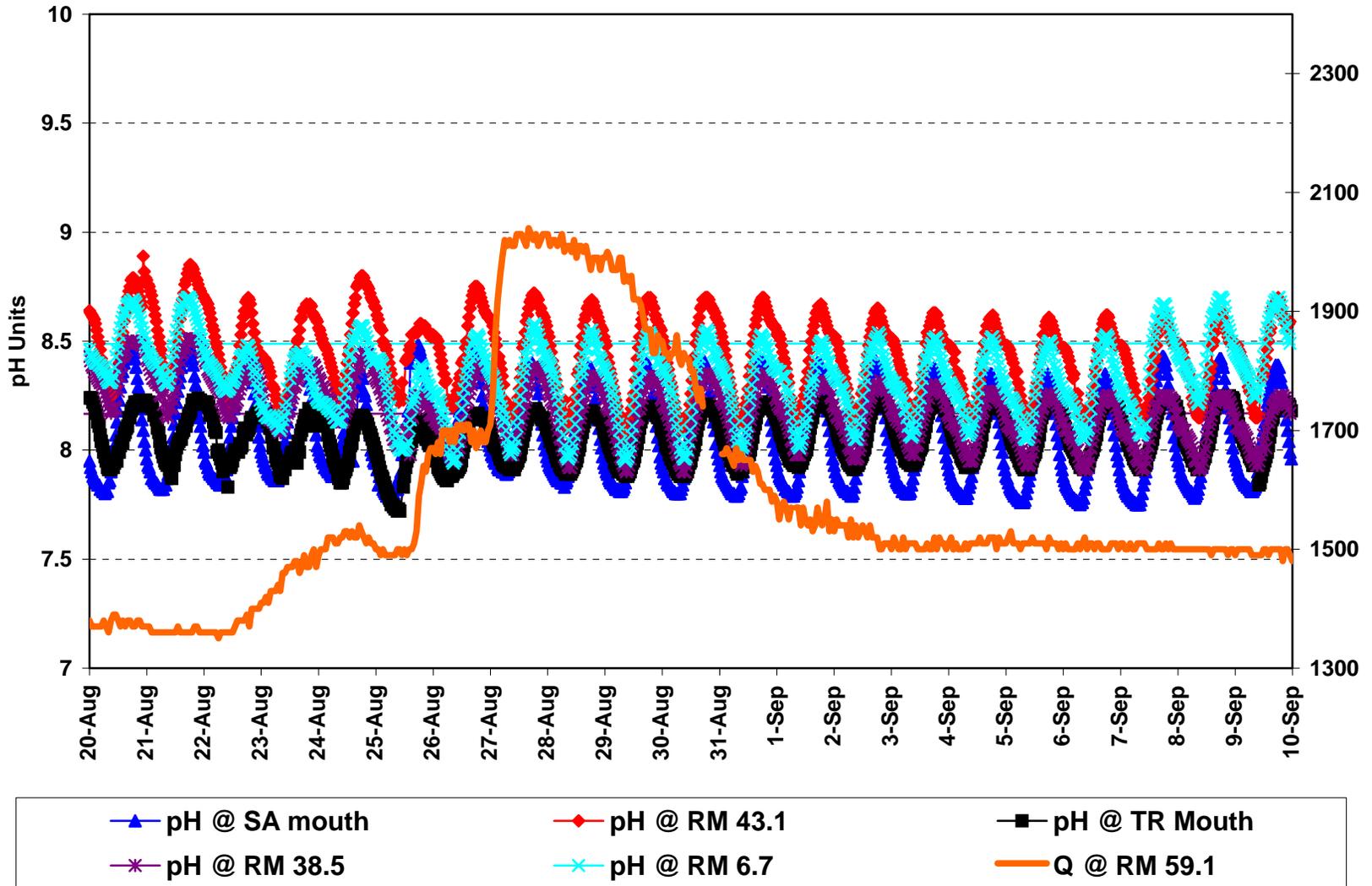
pH Levels



pH Levels



pH levels



DO/pH Summary

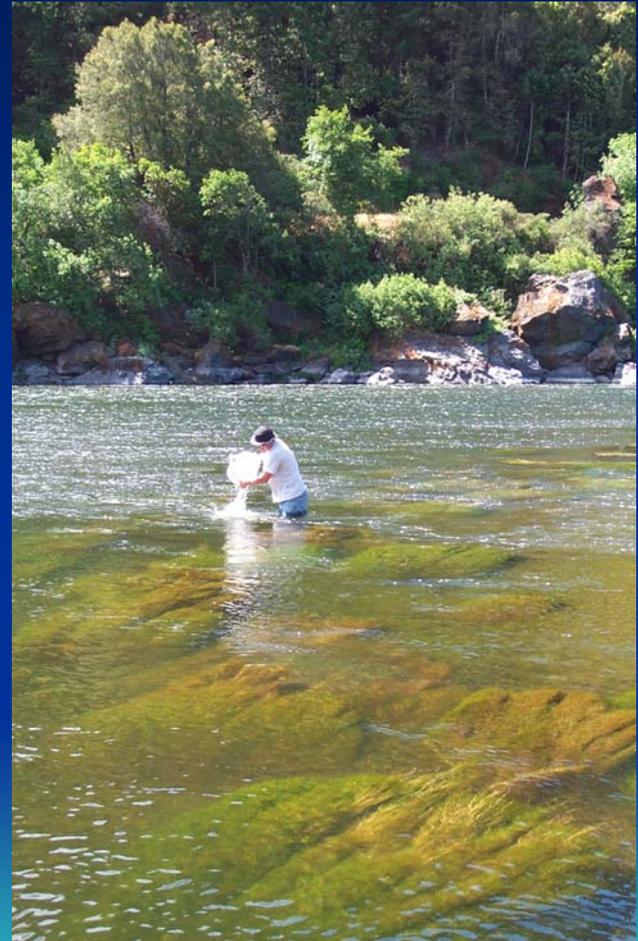
- Onset of pulse flow coincided with a notable decrease in DO and pH at RM 189.9, but little to no effect identified 12 miles below or beyond.
- Cooling trend with cloud cover at the time of the release may have masked any effects of the pulse to DO and pH during times of increased turbidity



Future Studies

Evaluate substantial flow increases and associated effects on downstream water quality

- Select Nutrients
- Bacterial levels
- Associations to primary productivity (i.e DO/pH associations)
- Improve sampling design and coordination
 - Increase sample frequency at select sites at closer intervals to capture trends better
 - Arm oneself with improved knowledge of flow travel time
 - Collaborate and coordinate with partners





The End